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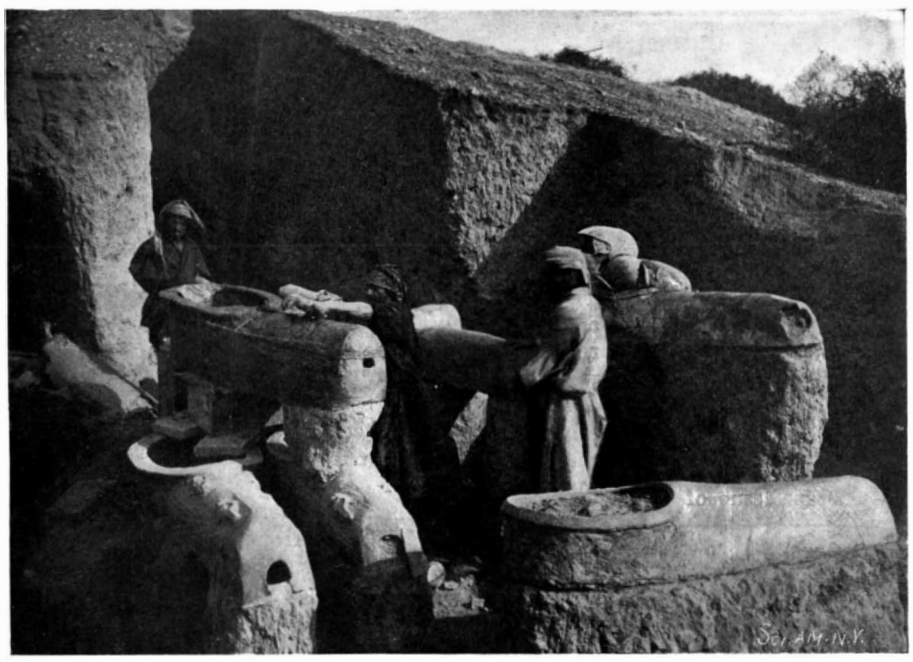
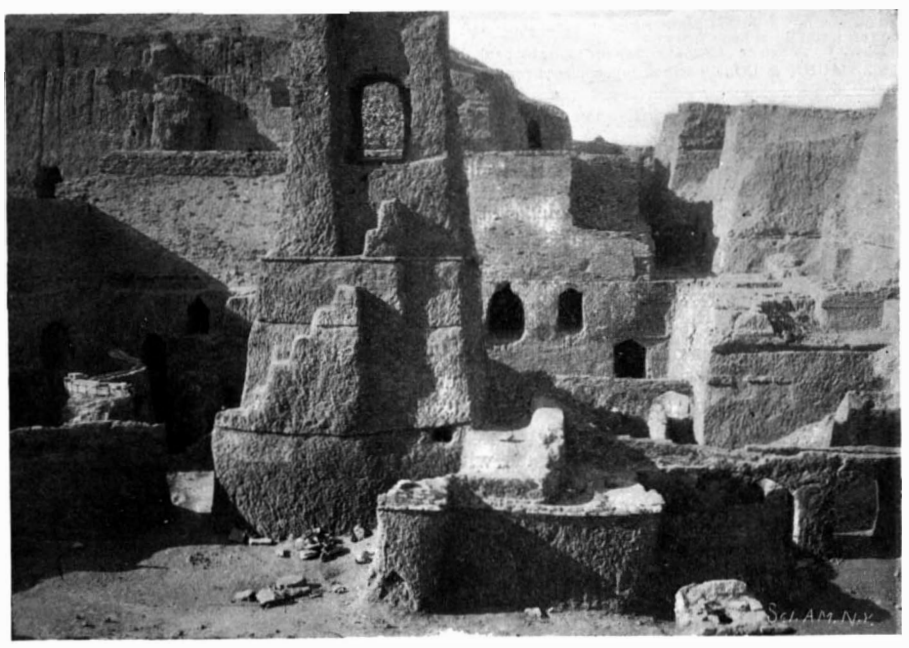


Excavation of Slipper-Shaped Coffins.



Excavations in Pre-Sargonic Strata to Water Level.

View of the Temple Area and Inclosure, 2800 B. C.—Excavations in Pre-Sargonic Strata in Foreground.

RECENT EXCAVATIONS CARRIED ON BY THE UNIVERSITY OF PENNSYLVANIA AT NIPPUR, BABYLONIA.—[See page 133.]

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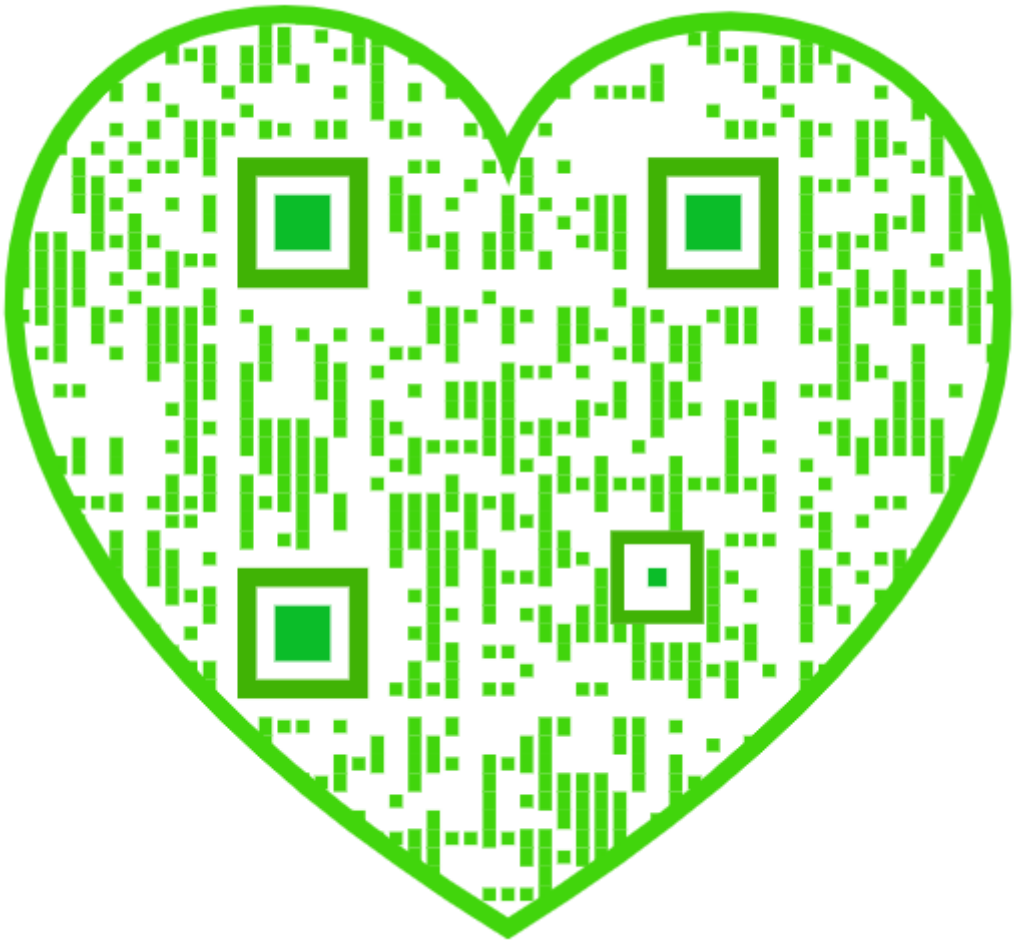

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NEW YORK, SATURDAY, MARCH 2, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CABLES FOR THE NEW EAST RIVER BRIDGE.

Within a few days the preliminary work for stringing the great cables of the new East River Bridge will be in full swing, and such have been the improvements in this important and very special line of work since the construction of the Brooklyn Bridge twenty years ago, that it is likely all four cables will be in place before the close of the present year.

The four main cables will be 18¾ inches in diameter, and each will consist of thirty-seven strands, each strand being made up of 282 steel wires 1-6 of an inch in diameter. In each cable, therefore, there will be 10,434 wires, with an ultimate or breaking strength of about 20,000 tons, a total of 41,736 wires with a combined strength of 80,000 tons. This means that the four cables would be equal to lifting by a direct vertical pull a fleet of eight warships of the size of the armored cruiser "Brooklyn." That the cables should have such an enormous aggregate strength will be fully understood, when we remember that each square inch of section of the wire is required by contract to have an ultimate strength of 100 tons.

Preparatory to stringing the wires of the main cables four temporary footbridges will be erected for the construction of each cable. Each pair of footbridges will be thoroughly braced together, and also at intervals there will be transverse footways connecting the two pairs. The four footbridges will be double-decked, the lower deck being about 15 feet below the upper deck. The upper deck will be utilized for making the thirty-seven strands of which each cable is composed, and, as each strand is completed, it will be lowered several feet to the position which will be occupied by the finished cable.

The working platforms or footbridges, although they are merely temporary affairs, will require four cables, of an aggregate strength of 2,500 tons, to carry them, and the cost of constructing these platforms will be not less than $200,000. The stringing of the footbridge cables will be carried out in a novel manner, as follows: A lighter, on which will be placed the reels of cable, will be moored at the foot of the New York tower. A line will then be attached to one end of the cable, which will be hoisted to the top of the tower, carried over a temporary saddle, and down to the New York anchorage, where it will be made fast. The lighter will then be towed across the river and the cable being paid out as it advances, and allowed for the time being to lie upon the bottom of the river. The end of the cable will then be drawn up over the Brooklyn anchorage. When the four cables have been swung, floorbeams will be laid across them, and the planking and handrails will be put in place, thus affording a continuous footway or working platform from the anchorages up to the towers and across the whole wide span of the river. After the cables are completed they will be clamped with bands of steel to which will be attached the suspenders from which the stiffening trusses and floor will be hung. The cables will be filled in with a protecting substance composed of oil and pitch, etc., and then they will be completely inclosed with half-round steel plates which will overlap each other so as to completely shed the rain water and give a thorough protection against the weather.

THE RETIREMENT OF REAR-ADMIRAL HICHBORN.

The retirement of Rear-Admiral Philip Hichborn on account of age limit, which takes place on the fourth of this month, marks the close of an official life which has been most intimately associated with the history of the United States navy, not merely in connection with what might be known as the steam-and-steel period, but also with that of the wooden hull and sail-power. The retiring chief naval constructor forms a link between the old and the new schools of construction. His first practical experience in the navy consisted of five years of apprenticeship to the government as a shipwright in the Boston navy yard, where for a few years he acted as assistant secretary to Admiral F. H. Gregory. After a course of theoretical training in ship designing, Mr. Hichborn moved to the Pacific coast, where we find him at Mare Island as a journeyman shipwright, timber inspector, draftsman shipwright, and finally in 1862 as master shipwright, a responsible position for a young man but twenty-three years of age. In 1869, seven years later, he was appointed assistant naval constructor with the rank of lieutenant. The following year he was ordered to report to Portsmouth navy yard, where he supervised the building of the wooden steam vessel "Essex," which, by the way, was recently refitted at the New York navy yard and is now doing duty as a training ship. In 1875 he received his commission as Naval Constructor.

Mr. Hichborn's connection with the new navy dates from the year 1880, when he was selected to serve as a member of the first Naval Advisory Board. In 1884 he made a tour of investigation of the navy yards of Europe and on his return published a report on European dockyards, the demand for which was so great that Congress authorized the printing of two editions. On his return from Europe he was ordered to the Navy Department at Washington as Assistant Chief of the Bureau of Construction and Repair, and on July 12, 1893, he was appointed chief of the same bureau, a position to which he was reappointed four years later and from which, by virtue of age limit, he now retires. For a more detailed account of Rear-Admiral Hichborn's life and work, we refer our readers to an article in the current issue of the SUPPLEMENT.

AERONAUTICAL CONGRESS.

REPORTED BY THE SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Congress of Aerostatics has been one of the most interesting of the series held at Paris during the Exposition. It was presided over by M. Janssen, Director of the Observatory of Meudon, in which the meetings were held. The different governments sent official delegates; those of the United States were Messrs. Chanute, Gallice, Langley, Marvin, Rotch, Poëy, and Zahm. The list of delegates included a great number of names prominent in aeronautic and scientific work, such as Aimé, Bereau, Bonaparte (Prince Roland), Bruce, Saint Victor, De Dion, Giampetro, De Fonvielle, Lieut. Hinterstoesser, Hammer, Count de la Valette, Morani, Richard, Santos-Dumont, Tissandier, Tzerseleff (Prince Dimitry), etc. The French army and marine were represented by a number of delegates. The principal address was delivered by M. Janssen, in which he reviews the progress already made in aerostatics and the results hoped for in the future. Since the last Congress, held at Paris in 1889, a considerable progress has been made in the different branches. In France and the leading nations the governments have taken up the subject, and its importance in military operations is becoming more clearly recognized. If it is considered that the armies are constantly increasing, as well as the range of the arms of artillery and infantry, a like extension of the theater of combat is to be predicted, and in consequence the use of balloons will become indispensable, and these will be provided with more powerful optical appliances. It must not be forgotten that balloons play an important part in indicating to the artillery the efficacy of its fire and the corrections to be given. If, on one hand, it is pleasing to record the progress which military aerostatics has accomplished in the hands of the skilled officers charged by their governments with the establishment and operation of these services, it must be acknowledged that great desiderata still exist. In fact, if it is possible to leave a besieged place almost with impunity, it is not the same for re-entering; it is to this second phase of the question that the subject of the direction of balloons is attached. Since 1889 the great problem of the dirigibility of balloons has occupied many workers, but it should be said that in spite of the very interesting attempts, the question has not made a decisive step. The experimenters are, however, still at work. M. Santos-Dumont is preparing for the competition for the Deutsche prize of $20,000, and Count Zeppelin is making a great effort with his balloon of 360 feet on Lake Constance. Although the question of dirigibility is the most important, it is also of the greatest interest to improve the aeronautic conditions, either as to remaining as long as possible in the air or to rise to a great height. In this order of facts may be cited the remarkable voyage of Count de Castillon de Saint-Victor from Paris to Sweden, where the balloon covered more than 800 miles, and that of Count de la Vaulx, who kept his balloon in the air for more than 30 hours without landing. M. Mallet has made with the same balloon a tour of France lasting eight days, landing in different places. As regards the altitude reached, the record has been made by M. Berson, of the Meteorological Institute of Berlin, who has risen several times to a height of 28,000 feet, exceeding the highest summits of the Himalayas; it is by the use of oxygen that M. Berson was able to support the rarefaction of the air at this great height. Scientific ascensions have made great progress in Germany owing to the initiative of the Society of Aerial Navigation of Berlin, which is sustained by the liberality of the Emperor. During the last five years the number of these ascensions has reached no less than seventy-five, and the results obtained have lately been discussed in the extensive treatise of Assmann, Berson, and Gross. But the heights attained by these balloons carrying observers are necessarily limited. Even with the use of oxygen, the observer must contend with the depression which surrounds him, and from which results an expansion of all the gases contained in the system, which, in spite of the respiratory reparation due to oxygen, may lead to death. M. Janssen then speaks of the scientists and aeronauts whose loss is to be regretted, among others Eugene Godard, originator of siege balloons, and from whom the author obtained excellent counsels at the time of leaving Paris the 2nd of December, 1870, during the siege with the balloon "Volta;" Hureau de Villeneuve, one of the founders of the Society of Aerial Navigation; Gaston Tissandier, Coxwell, and others. M. Janssen closes his address by a review of the advantages which would result from the mastery of the air and the effects this would have upon civilization.

The Congress was divided into four sections, and in each a number of interesting papers were read. The following is a list of the sections and some of the communications for each: Section 1. Aerostatics. Aimé; dirigible thermosphere. Angelot; new system of balloons. Dibos; signals from balloons at great distances. Giampetro; use of sails in direction of aerostats. Jaguaribe, new apparatus (velo-aerian). Reynard; ascensional propeller. Zahm; theory of balloon direction, etc. Section 2. Aviation. Ader; military aviation. Alexander; force of helices. Bretonnière; study of flying and aeroplanes. Canovetti; experiments on the resistance of air. Herard; new propeller. Mortureux; aerocycle with four wings. Rotch; use of kites at Blue Hill, United States. Roux; study of the flight of birds. Santi; aeroplanes, etc. Section 3. Instruments. Assmann; scientific aerial voyages. Batut; aerial photography from kites. Bouquet de la Grye; aerial telegraphy from balloons. Bruce; luminous balloons for military signals and exploration. Dibos; project of exploring voyage in Central Africa. Rotch; kite apparatus. Triboulet; method of triangulation by panoramic apparatus, etc. Section 4. Legislation. Formation of a scientific commission for the study of aerostatic patents. De Villiers; role of military aeronauts in the Egyptian campaign. Pesce; aeronautic and maritime rights, etc. A number of these papers, which are of great interest, will be reproduced in full or in abstract.

LOTUS POISON.

Messrs. Dunstan and Henry have recently read a paper before the Royal Society, treating of the nature and origin of the poison of the Lotus Arabicus. This is a small leguminous plant, indigenous in Egypt and the north of Africa. It grows abundantly in Nubia and especially along the borders of the Nile, from Luxor to Wadi-Halfa. It is known to the inhabitants under the name of "Khuther;" the plants whose grains are ripe serve as fodder, but at certain epochs of its growth the plant is quite poisonous for horses, sheep and goats, the poisonous properties are most strongly marked in the young plant and continue up to the time that the grains appear. As this plant has caused considerable trouble to the civil and military authorities of Egypt, a complete study of it has been made at the Royal Institute of London, after the material collected by Mr. E. A. Flayer, Director of Egyptian Telegraphs. The dry plant is of a brilliant green color and has the odor of freshly-cut hay. When wet with water and ground, the leaves of the plant give off a considerable quantity of hydrocyanic acid. This quantity is a maximum in the plant just before or just after flowering. It is found that the prussic acid comes from a crystalline yellow glucoside, having the formula O_{22} H_{19} NO_{10}, which is called *lotusine* by the experimenters. Under the influence of an enzyme, also contained in the plant, the lotusine is transformed into prussic acid, sugar, and a new yellow coloring matter, called *lotoflavine*. The action takes place also under the action of acids, but is produced only slowly with emulsine and not at all with diastase. The experimenters propose to call the new enzyme *lotase:* it seems to be distinct from all the others known. Its activity is nullified by the action of alcohol, and it has but little action upon amygdaline. The old plants contain lotase, but not lotusine. The sugar formed by the action is identical with ordinary dextrose. The lotoflavine has a composition which corresponds to the formula $C_{15}H_{10}O_6$. It belongs to the class of pheno-y-pyrones; it is a dihydroxychrysine, isomeric with luteoline, the yellow coloring mat-

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ter of the Reseda luteola. The decomposition which is produced when the lotase is put in contact with the lotusine, this taking place when the plant is ground with water, is represented by the following reaction: $C_{22}H_{19}NO_{10}$ (lotusine) + $2H_2O = C_{15} + H_{10}O_6$ (lotoflavine) + HCN + $C_6H_{12}O_6$ (dextrose). Hydrocyanic acid is found in small quantities in many plants, and according to Treub and Greshoff it is often present in the atmosphere. The only glucoside well known at present which produces this acid is the amygdaline of bitter almonds, which, under the influence of emulsine, also contained in the almonds, forms dextrose, benzaldehyde and prussic acid. This new glucoside presents, therefore, a great scientific interest.

ESTIMATION OF TUNGSTIC ACID IN ITS ORES.

Carrying out the method recommended by Blair in his "Chemical Analysis of Iron," page 264, Mr. Herbert M. Shilstone made a large number of tungstic acid determinations in wolfram and scheelite ore concentrates for the American Tungsten Mining and Milling Company, of Long Hill, Conn., a few months ago, and found the following methods very satisfactory, accurate results having been obtained without excessive care or unusual precaution.

For the analysis of wolfram he proceeds as follows: The ore concentrate is very finely pulverized and passed through a No. 13 bolting cloth. From 0.3 to 1.00 gramme is weighed and brushed into a small beaker, nitric acid is added, the beaker covered, and the whole digested or heated on the water bath for one-half hour. Hydrochloric acid is now added, and the digestion continues until the ore concentrate is thoroughly decomposed. It is generally left on the water bath all day. It is necessary to replenish the nitric and hydrochloric acids during the digestion, retaining about 25 cubic centimeters of solution in the beaker all the time.

When the ore concentrate appears to be perfectly decomposed it is evaporated to dryness on the water bath (a higher temperature is not desirable), is then redissolved with hydrochloric acid and evaporated down again, redissolved again with hydrochloric acid, diluted with water, filtered, washed thoroughly with acidulated water and then with alcohol. The tungstic acid now remains on the filter along with the undecomposed silica, etc.

It is treated on the filter with ammonia, the filtrate allowed to run into a platinum dish, then evaporated to small bulk, and excess of ammonia added, filtered again if necessary into a platinum crucible, evaporated carefully to dryness, heated gently to drive off the ammonia and finally ignited at a high heat. Cooled and weighed as tungstic acid.

If the ore concentrate is not thoroughly decomposed in the first case, the residue from the first filter must be redigested with acids, treated as before and the result added to the first.

For scheelite he uses a fusion method (as per Fresenius' Zeitschrift, 29, pages 104, 105), which he finds gives results as accurate and is more rapid in operation.

From 0.3 to 1.00 gramme of the finely powdered ore concentrate is mixed with about 10 grammes of equal parts of soda and potash carbonates and fused in a 2-ounce crucible for two hours; the crucible is now given a circular motion so as to coat the inside with the melt, and then chilled by immersing in a beaker of cold water, without letting the water in the top of the crucible. When cool the melt probably will crack away from the sides of the crucible; if not, the crucible must be laid on its side in a small beaker just covered with water and digested on the water bath until the melt is dissolved. The crucible is washed thoroughly and the washings run into the same beaker; it is better to rinse the crucible finally with a dilute solution of hydrochloric acid which must be kept for further use. Continue the digestion of the melt until it is thoroughly decomposed and the soluble tungstate of soda dissolved in the hot water, filter off the undissolved residue and wash thoroughly with hot water.

The acid washings of the crucible are now added to about 200 cubic centimeters of a 25 per cent solution of hydrochloric acid and brought to a boil, the filtrate containing the tungstate of soda is added slowly and constantly stirred, and the beaker is kept covered to avoid loss by spitting as much as possible. A precipitate of tungstic acid will be thrown down if there is an excess of acid; if not a further addition of boiling hydrochloric acid must be added until it gives an acid reaction with litmus paper; the boiling is continued for one-half hour, the beaker removed from the fire and allowed to stand twelve hours in the cold. Filter off as much of the supernatant liquid as possible, never filling the paper more than half full, add a little water and a few drops of nitric acid to the precipitate and transfer as carefully as possible to the filter, taking all precautions. For a very fine precipitate mop out beaker and wash precipitate until washings are no longer acid, dry in the air bath at 110 deg. C., remove the precipitate from the filter and ignite the filter paper, moisten the ash with a few drops of ammonium nitrate and ignite again, add the precipitate of tungstic acid, ignite first at a low heat and finally at a high temperature, cool and weigh as tungstic acid.

THE HEAVENS IN MARCH, 1901.

BY HENRY NORRIS RUSSELL, PH.D.

This is another uneventful month from an astronomical standpoint. Of all the planets only Mars is visible in the evening sky; and so we may well devote part of our time to the consideration of the strange markings on his surface, as was promised a month ago.

These objects, the so-called "canals," were discovered by the Italian astronomer, Schiaparelli, about fifteen years ago, and have since been seen so frequently, and by so many observers, that there is now no doubt of their reality. They appear, under favorable conditions, as fine straight dark lines running across the ruddy parts of the planet's surface—the so-called continents—in all directions. Their actual width must be 40 or 50 miles at least, since a narrower line would hardly be visible at so great a distance. Many of them reach the "seas" just at the head of some bay and frequently three or more converge accurately to a single point. Most remarkable of all, a large number of them have, at certain times, been seen "doubled," the single line being replaced by a pair of parallels, two or three hundred miles apart, and this duplication seems to follow the course of the Martian seasons. When the air is unsteady, the canals appear as faint, ill-defined streaks; and some of the ablest observers have never seen them otherwise.

They are very difficult objects to observe, but nevertheless, the facts of observation have accumulated far more rapidly than satisfactory explanations for them. They can hardly be rivers, because they are quite straight, and frequently run from one sea to another. It has been suggested that they are cracks in the planet's surface, but though this accounts for their straightness, it hardly explains the regularity of their arrangement, and much less their duplication.

A mere glance at one of the recent drawings of Mars suggests with great force another hypothesis—namely, that the canals are artificial structures of some sort. But here again we meet with serious difficulties. Why should an artificial waterway be fifty miles wide? And how can their doubling be accounted for?

Perhaps the best of existing theories, and certainly the most stimulating to the imagination, is that proposed by Mr. Lowell and his fellow-workers at his observatory in Arizona, who have devoted a great deal of attention to the subject. He regards the dark greenish portions of Mars' surface as areas covered, not with water, but with vegetation, while he believes the ruddy areas to be deserts. The planet's surface is evidently pretty flat, as mountain ranges, if present, would be conspicuous, just as they are on the moon. According to Mr. Lowell, there is much less water on Mars, in proportion to his surface, than on the earth, and much of it is frozen up in the polar ice-caps during the Martian winter. As the ice melts in the spring, the water floods the lower lying regions of the surface—the "seas"—and keeps them green and flourishing. The canals are artificial watercourses, built to carry off the water where it is needed. On each side of them is a strip of irrigated land, bearing the same relation to them that Egypt does to the Nile, and it is this belt which is wide enough to be visible from the earth. The duplication of the canals is accounted for by the ingenious idea that, for some reason, the Martians cut the water off from the central part of this strip first, so that it dries up while the edges are still green.

Mr. Lowell has a good many other facts to back up his theory. One of the most important is that he has seen a number of the canals prolonged upon the "seas." It is hard to see on the old theory how a canal could be dug in the ocean, but there is nothing very remarkable in a belt of dense vegetation near an irrigating canal in a sparsely grown tract. There are also many instances of seasonal change among the canals, and certain parts of the seas, which bear out his theory.

There is, however, something to be said on the other side. The regularity of the arrangement of the canals may be more apparent than real. When several faint lines near the limit of visibility are *nearly* straight, and intersect *near* the same point, the figure which they present, seen as it is only by glimpses when the air is steadiest, is very likely to be drawn by even the most careful observer as composed of *straight* lines, intersecting exactly in one point, so that too much stress must not be laid on the published drawings.

There is also a controversy in the astronomical world as to the reality of the doubling of the canals. Prof. W. H. Pickering has pointed out that lines a little out of focus are often seen double. Any one may verify this by following his directions. Draw a few fine dark lines on a piece of paper; place them three or four feet from the eyes, close one eye, and look with the other at the finger held a foot or less from the face. The lines will appear distinctly double. Of course he does not deny that observers have focused their telescopes properly; but the eye when tired with long or careful gazing may, and often does, alter its focus suddenly and almost arbitrarily. This explanation is, however, strenuously opposed by many observers and the question is by no means settled.

Another objection of a different kind raised against the vegetation theory is that Mars receives much less heat from the sun than the earth does, and, unless he has much more internal heat, it is hard to see how his ice-caps can be so much smaller relatively than the earth's. Other substances might freeze and melt in the same way; the polar caps might be of frozen carbon dioxide, or even frozen in as far as their telescopic appearance is concerned.

So at present we can only say that no completely satisfactory theory of the condition of Mars' surface has been advanced, much less demonstrated, although those which assume the presence of intelligent life on the planet will always remain the most attractive to the imagination.

THE HEAVENS.

The western sky still contains the familiar winter constellations. Along the Milky Way lie Cassiopeia, Perseus, Auriga, Gemini, Canis Minor and Canis Major; and west of it the most conspicuous groups are Orion and Taurus.

At our chosen hour of 9 P. M. on the 15th Ursa Major is well above the pole. Besides the Dipper one can easily recognize the group of stars nearer Capella which form the animal's head, and the three pairs of small stars, almost in a straight line, which lie to the southward above Leo, and mark its paws. In the northeast are Bootes and Corona Borealis, and farther south is Virgo. Leo, identified by the conspicuous "sickle," with Regulus at the end of its handle, is approaching the zenith. Between Regulus and Procyon, a small group forms the head of Hydra, whose body is marked by a long line of rather inconspicuous stars extending eastward beyond the horizon.

THE PLANETS.

Mercury is evening star till the 7th when he passes between us and the sun and becomes a morning star once more. He will not be visible to the naked eye till near the end of the month, when he rises over an hour before the sun. On the afternoon of the 12th he is in conjunction with Venus. Venus is still morning star, but is now so nearly behind the sun, that she rises but forty minutes earlier on the 1st and only twenty minutes before him at the month's end. Mars is conspicuous in the east in the early evening, and passes the meridian about 10 o'clock in the middle of the month. He is beginning to recede from the earth, but is still very bright. Jupiter rises about 2:30 A. M. on the 15th, Saturn about 3 o'clock, and Uranus a little before one. Neptune is still in Taurus, setting about midnight.

THE MOON.

Full moon occurs early on the morning of the 5th, last quarter on the forenoon of the 13th, new moon on that of the 20th, and first quarter on the night of the 26th. The moon is nearest the earth on the 20th, and farthest away on the 8th.

She is in conjunction with Mars on the morning of the 4th, Uranus on the evening of the 12th, Jupiter on the afternoon of the 14th, Saturn the next morning, Mercury on the night of the 18th, Venus on the afternoon of the 19th, Neptune on the morning of the 26th and Mars once more on the evening of the 30th.

On the night of the 20th the sun enters the sign of Aries, and spring begins.

Oyster Bay, January 21, 1901.

MUSICAL SOUNDS FROM THE ELECTRIC ARC.

Mr. W. Duddell, an electrician of London, has discovered a method of producing musical sounds from the electric arc, and recently gave a lecture upon these investigations before the London Institution of Electrical Engineers. It is only the solid carbon, that which is homogeneous in its nature, that is capable of producing these unusual sounds. The cored carbons are absolutely silent. Not only is it possible to obtain musical sounds, but they may be varied so as to produce a tune, and to exemplify his thesis, the inventor played a popular air. The variations in the sounds are accomplished by a by-pass or shunt placed across the carbons, and which have the same effect as the fingers and keys upon a flute. Mr. Duddell, in the course of his lecture, arranged four arcs in series to increase the intensity of the sound, and by varying the self-induction and capacity in the shunt circuit by means of a keyboard, of two octaves, produced his tune. The keyboard may be placed at any distance from the lamps without depreciating the musical effects emitted by the arcs. The inventor has also requisitioned the electric-light arc for receiving telephonic messages transmitted from another point of the building.

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AN AUTOMATIC REDUCING VALVE OF NOVEL FORM.

In order to control the flow of illuminating gas, or of compressed air used as a motive agent, or of any fluid under pressure, a highly sensitive valve is required which automatically maintains a constant current. As a highly efficient type of such valves we have selected for illustration the very ingenious device made by the Automatic Reducing Valve Co., 125 La Salle Street, Chicago, Ill.

The valve comprises essentially a pressure-chamber, provided with an inlet and an outlet; a closure for the inlet; and a spring-pressed diaphragm controlling the closure.

As shown in one of our illustrations, the closure consists of a carrier, in one side of which a single large elastic roller, *A*, is mounted, and in the other side of which two small metallic rollers, *B*, are journaled. The large rubber roller serves as a valve for the inlet; while the two small rollers serve primarily as anti-friction devices to facilitate the movement of the carrier.

Mounted on the carrier is a flexible diaphragm, *C*, clamped in place by a cap threaded on the pressure-chamber and utilized to regulate the inflow of gas. Within a tube screwing in the cap a coiled spring is inclosed, which bears upon a plunger projecting from the carrier and upon a disk secured to a screw-shaft formed on a milled head. The disk is provided with a pointer projecting through a slot in the tube and playing over a scale. By turning the milled head the pressure of the spring on the carrier-plunger can be varied.

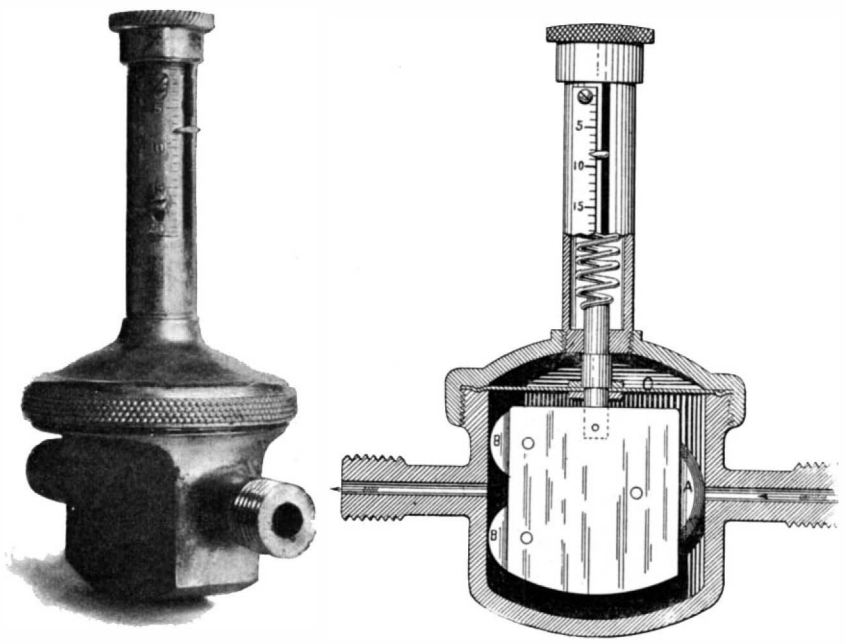
Whatever may be the pressure within the tank or pipe to which the device is applied, the roller, *A*, will close the inlet, the pressure being sustained or supported by the carrier and its rollers, *B*. Upon turning the milled head, the spring is made to press upon the carrier-plunger, so that the roller, *A*, is moved to uncover the inlet, and to allow an amount of gas to pass which is proportionate to the degree of compression of the spring. When the pressure becomes excessive, the diaphragm, *C*, will be forced outwardly, thereby moving the carrier and causing the roller, *A*, to close the inlet. When the pressure falls again the diaphragm moves the roller, *A*, away from the inlet.

The novel feature of this reducing valve is the rolling closure, which is far more delicate in its opera ion than the ordinary sliding closure. For it is evident that as the roller, *A*, moves the inlets are opened or closed in a constantly increasing ratio. Hence a very slight movement of the diaphragm is so considerably multiplied at the roller, that the least increase or decrease of pressure is sufficient to close or open the inlet.

Another pre-eminent feature of this valve is its ability to maintain automatically a uniform low pressure independent of the varying high pressure.

THE LARGEST CAMERA IN THE WORLD.

Photographic progress has been so rapid in the last few years that we have arrived at the point when we are not surprised at any new developments in processes, but the idea of a negative 8 by 10 feet, or 96 by 120 inches, is certainly startling. The camera which we illustrate is by far the largest ever constructed, and in all probability it will hold this distinction for many years to come. During the summer of 1899, the workmen at the Pullman Works at Pullman, Ill., were busy building two trains, the plans for which differed materially from anything which had hitherto been built. These trains were for the Chicago and Alton Railway, and they were to be the handsomest trains in existence. The company desired fine photographs for exhibition at the Paris Exposition and elsewhere, and Mr. George R. Lawrence, their photographer, was requested to build the largest camera in the world, especially to photograph the "Alton Limited." Mr. Lawrence was given *carte blanche*, and in two and a half months the great camera was completed. It was designed and built in Chicago and it is finished throughout in natural cherry. The bed is composed of four 2 by 6 inch cherry beams, and is about 20 feet long when fully extended. The bellows is made with an outside covering of heavy rubber, each fold being stiffened by a piece of whitewood a quarter of an inch thick. It was then lined inside with heavy black canvas and an additional lining of thick black, opaque material. In the construction of this bellows over 40 gallons of cement, two bolts of wide rubber cloth and 500 feet of quarter-inch white-

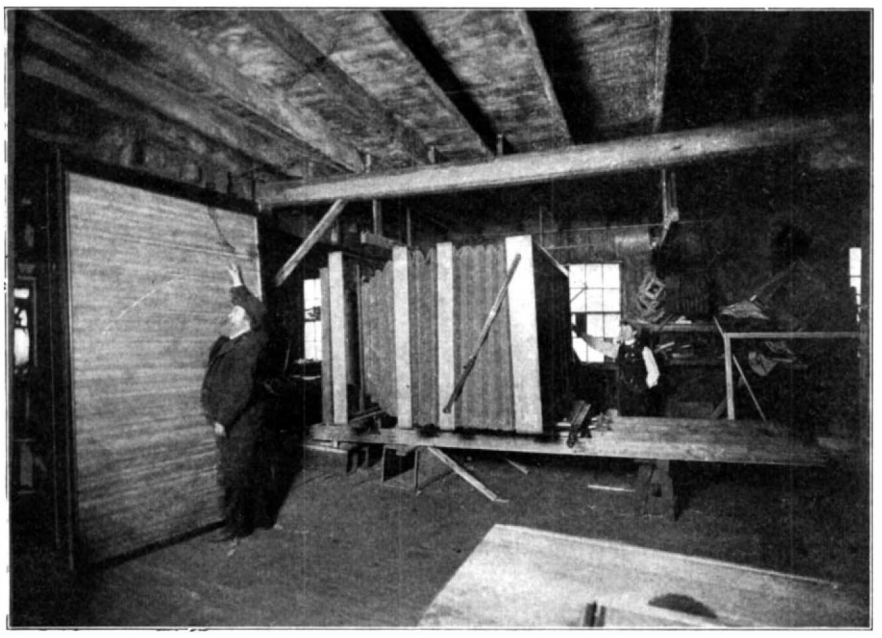


AN AUTOMATIC REDUCING VALVE.

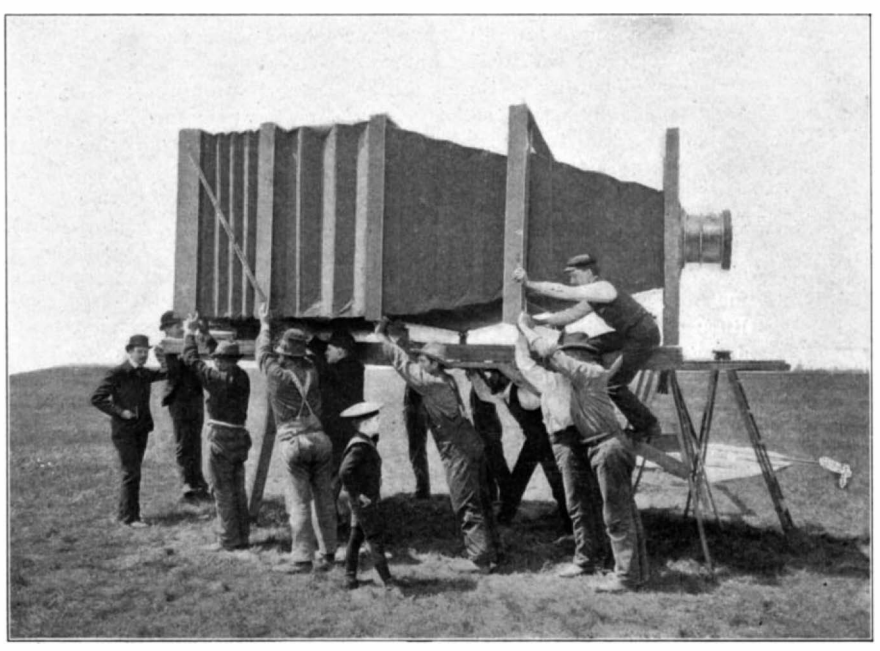
wood were used. The bellows is divided into four sections, as shown in our engraving, and between each section is a supporting frame mounted on small wheels which run on a steel track; the back supporting the plate-holder is operated as easily as in an ordinary camera. The instrument has double-swing front and back and at the rear is a small track on which two focusing screens are moved back and forth like a sliding door. The plate-holder is of the roller-curtain type. This curtain contains about 80 square feet of ash ⅜ of an inch thick, and is lined with three thicknesses of light-proof material. Over ten gallons of cement were used in the construction of this curtain, and it is mounted on a ball-bearing roller. Ball-bearing rollers are also mounted every 2 inches in the grooves in which the edge of the curtain slides, thereby reducing the friction to almost nothing. The weight of the camera is 900 pounds and the plate-holder when loaded weighs 500 pounds, making the total weight 1,400 pounds. The camera is so constructed that after a long journey the plate may be dusted in a unique manner. The holder is put in position, the large front board, or front door, as it may be called, is swung open; the operator passes inside, the door is then closed and a ruby glass cap is placed over the lens, the curtain slide is drawn and the operator dusts the plate in a portable dark room, after which the slide is closed and he passes out in the same way as he entered.

The Zeiss lenses for this camera are the largest photographic lenses ever made, one being a wide angle lens with an equivalent focus of 5½ feet and the other being a telescopic rectilinear lens of 10 feet equivalent focus, the latter being the one used in taking the photograph of the Alton Limited.

Early one morning last spring the camera was transferred from a padded van to a flat car, and the start was made for Brighton Park, at which point the first exposure was made. The services of no less than fifteen men were required. The day was clear and a perfect negative was secured after an exposure of two and a half minutes, on a Cramer isochromatic plate, this special plate being used to preserve the color value of the train. The first three prints were sent to the Paris Exposition. One of them was placed in the railway section, another was hung in the photographic section, while a third was accorded a place of honor in the United States government building. The stir which the immense picture created in Paris is shown by the fact that affidavits were required before the Exposition officials consented to label the exhibit the largest photograph ever made on one plate. The picture of the Alton Limited was to visitors at the Paris Exposition what the exhibition of English trains was to Americans at the World's Fair, Chicago.



CAMERA AND PLATEHOLDER.



"FOCUSING" THE CAMERA.

Boat for South Polar Expedition.—The ship which is to be used in the coming South Polar expedition, organized under the patronage of the Emperor William, is now being built at the Howaldt works at Kiel. The boat is to be 150 feet long and 36 feet maximum width. It will be provided with a triple covering of wood no less than 30 inches thick; this has been found necessary in order to resist the pressure of the ice. It will have no port-holes or windows. At the start the coal provision will be 400 tons and this is to be replenished at Capetown and Kerguelen by coaling vessels which will go to meet the ship. A full rigging of sails will be provided, besides the engine, and a speed of 7 knots an hour is allowed for. The expedition will include four scientific men, and for these two laboratories will be provided, which will be fitted up with the best available instruments. The personnel includes 5 officers and a crew of 20 men. The boat is to take along a captive balloon and 50 Siberian dogs for the sleighs; the kennels for the dogs are placed on deck. It is expected that the boat will be finished by May 1, 1901, and that the expedition will be enabled to start for the South Pole in the early part of next August.

An Expedition to Labrador.—A geological and geographical expedition to Labrador, Iceland and Greenland is being planned for the coming summer. Last summer five Harvard men went to Labrador with Dr. R. A. Daly, of the University Museum. This year's expedition will also be in charge of Dr. Daly, and will be larger than the previous one. The expedition will embark on a large steamer, and sixty men will probably be members of it, including students of geology, geography, botany, zoology, mineralogy, and all branches of natural history. The expedition will visit Iceland and the glaciers of West Greenland. A hunting party will be landed on the west coast of Greenland and in Labrador. The expedition will start June 26, and return September 20.

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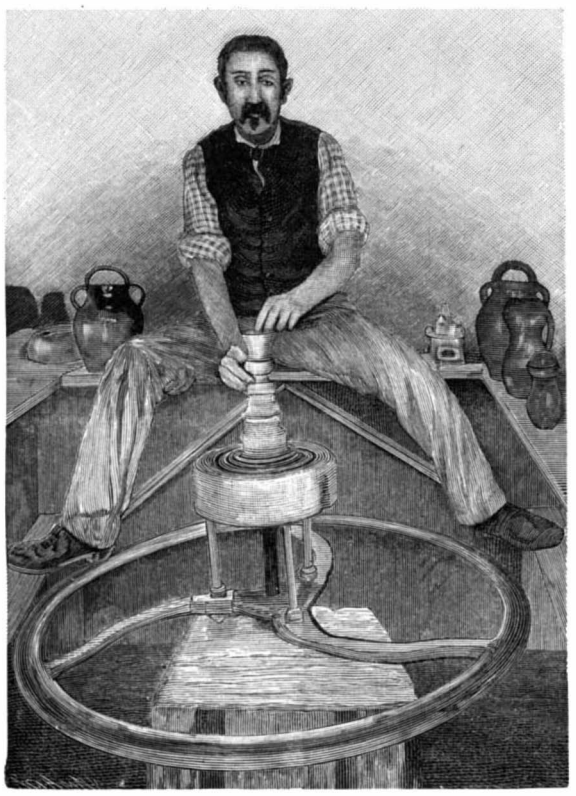
THE POTTER OF "OLD BERRY" AT THE EXPOSITION.

The tools of the potter have remained the same through ages, says Lectures pour Tous. It may be said that they are as old as the world. This is doubtless because, in their simplicity, they are admirably adapted for the use for which they are designed. The Egyptian potter who lived 2,000 years before Christ made use of nearly the same lathe and of the same wheel that was employed by the potter who was installed in



THE POTTER OF "OLD BERRY."

that part of the Exposition reserved for the exhibit of the French provinces of "Old Berry." A placard that swung from a nail in front of the shop gave the name of its occupant as:

"Alaphillipe, dit Charliton.
Potier, à Verneuil (Indre)."

Upon entering, the potter was seen seated upon a wooden bench, in his shirt sleeves, and in trousers soiled with clay. He was in the act of working upon the wheel of his lathe (which was actuated with his foot) a large ball of clay that had previously been tempered with water and kneaded in such a way as to form a very homogeneous mass. Giving the wheel a rotary motion, he seized the ball of clay between his fingers, under the pressure of which it was seen to elongate, turn around, and assume thousands of varied forms. It became successively a pot, a cup and a slender flagon, and then again a large-bellied pot. It was with this last creation that he stopped. Then he arrested the motion of the wheel, detached the object with a spatula, and added handles to it.

After allowing it to dry for two or three days, he glazed it with a mixture of ashes and clay, and baked it for thirty-six hours in a kiln. Such pottery, when finished, is somewhat dull of aspect, but excellent for domestic purposes. The potter avoided giving it that brilliant aspect that attracts the purchaser, since to that effect it would have been necessary to employ harmful substances.

A New Grain.

A new grain which has been grown to a limited extent in Manitoba this year is called spelt. It is said to be a Russian grain, and is ground in that country and in Germany. The seed was obtained from a foreign settlement in Dakota. It was sold in Winnipeg last summer to a number of farmers, and they all speak favorably of it. Though the season was a trying one, it produced good crops, as much as 50 bushels being obtained from one bushel of seed. It is claimed that spelt produces a heavy crop, is easily grown, and stands drought much better than most other grains, that it ripens early, and makes a superior feed grain for animals. The straw is also said to be better for feed than straw of other grains grown in Manitoba.

POD CORN.

Our engravings represents the sacred corn grown by a North American Indian tribe, the Abenikis. We are informed by the Division of Botany of the United States Department of Agriculture that this corn is well known under the name of pod corn, *Zea tunicata*. It has several vernacular names, such as California corn, cow corn, Egyptian corn, forage corn, husk corn, Oregon corn, primitive corn, Rocky Mountain corn, stock corn, in Africa "manigette," and in Buenos Ayres "pinsingallo." Each grain is completely covered by a separate husk. This kind of corn is not commonly grown, but our ordinary varieties, especially flint corn, often have one or more kernels covered with a separate husk. In rare instances, nearly all of the kernels on some ears have been covered in this manner. The origin of this corn, like that of our ordinary cultivated varieties of *Zea mays*, is not definitely known, but it is supposed to come from the region of Mexico or tropical America. In 1623 Bauhin obtained seed of *Zea tunicata* which was said to have come from Africa, but it is not at all probable that this plant is native on the eastern hemisphere. An account of this corn is contained in Bulletin 57 of the Office of the Experiment Stations of the Department of Agriculture.

EXCAVATIONS AT NIPPUR.

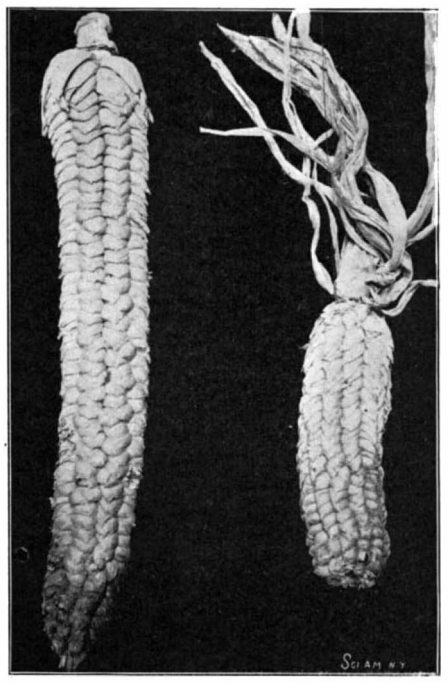
BY REV. ALBERT T. CLAY, PH.D.

The University of Pennsylvania in 1888 sent out an expedition to excavate Nippur, an ancient city of Babylonia. It is situated midway between the Tigris and Euphrates, about fifty miles to the southeast of Babylon. All that remains of the city is an extensive group of mounds, which rise on an average of about sixty feet above the plain. The mounds represent the accumulations of millenniums, the lowest stratum of which is found thirty feet below the present level of the plain, owing to the gradual filling in during the past ages.

For eleven years, including interruptions, the "deathlike stillness" which brooded over this ancient city (the probable site of Calneh, Genesis, 10: 10) with its treasures of long-forgotten millenniums has been dispelled, and the place has been the scene of much activity on the part of the American expedition. Though much has been accomplished in the laying bare of ancient buildings and the gathering of the exceedingly rich harvest of antiquities, yet at the present rate of operations, although on an average several hundred Arabs have been employed, it will require fully one hundred years to excavate thoroughly this ancient city.

The staff of the recent campaign, which has been the most remarkable for the richness of its finds and for the importance of its far-reaching results, consisted of Prof. H. V. Hilprecht, Ph.D., D.D., LL.D., Scientific Director: J. H. Haynes, Sc.D., Field Director; Messrs. Valentine Geere and Clarence Fisher, architects. Concerning the results of the campaign Prof. Hilprecht has been able to report that the most sanguine expectations have been realized.

City Wall.—Several years ago a trial trench was cut through the wall of the city, but recently a considerable portion of the wall was thoroughly excavated. It was ascertained that the first wall was built in the early pre-Semitic period (prior to 4000 B. C.). Upon this structure Naram-Sin (3750 B. C.) raised up his wall to a considerable height, using the characteristically large bricks of his period. Upon the remains of this splendid structure lie the bricks of Ur-Gur (2800 B. C.). The uppermost stratum contained the remains of a Jewish settlement, belonging to the late period. Rooms or shops for traders were built on the inside of the wall. From business records discovered Prof. Hilprecht infers that they were occupied during the third millennium before Christ.

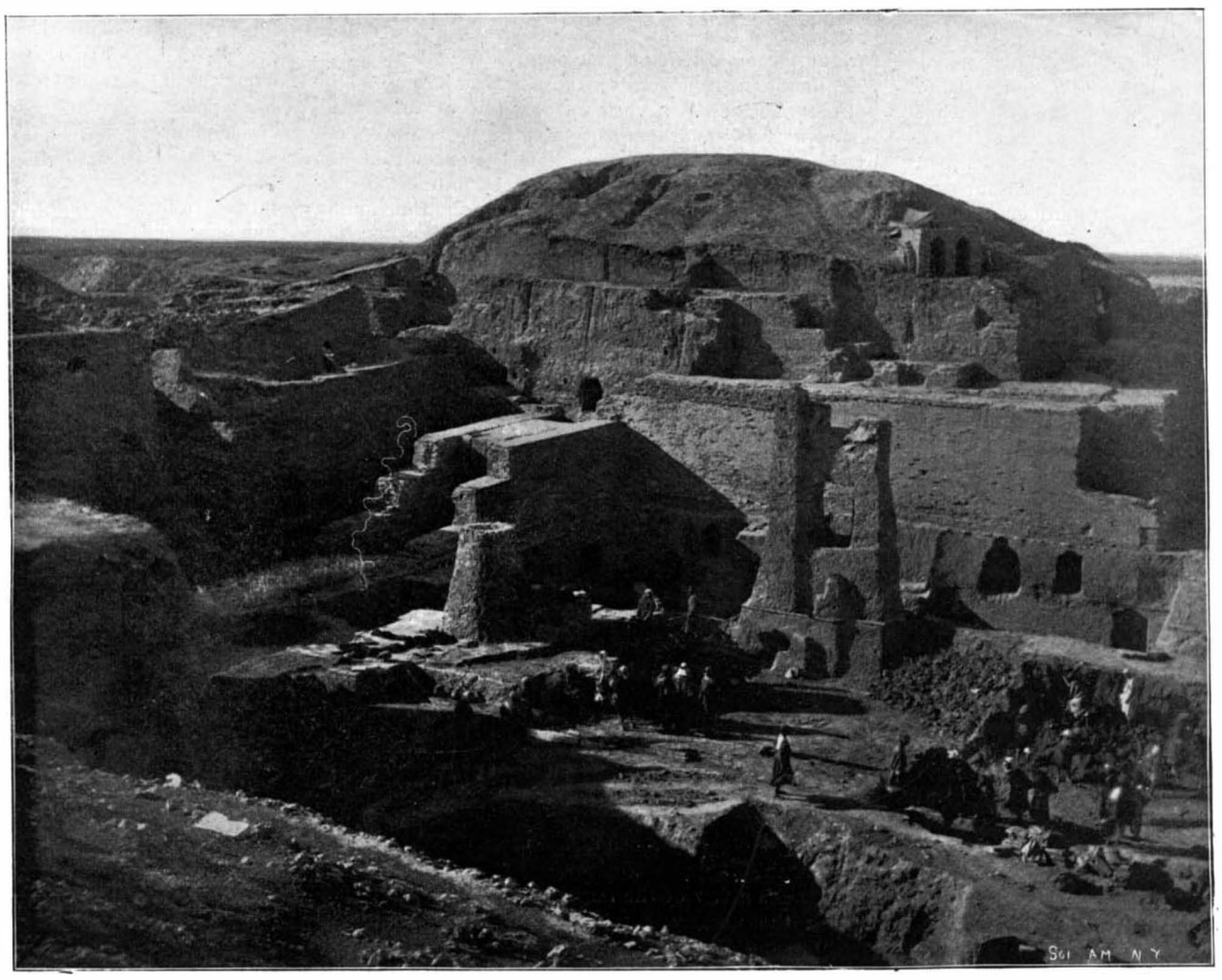


SACRED CORN GROWN BY A NORTH AMERICAN INDIAN TRIBE (ABENIKIS).

Each grain is completely covered by a separate husk.

The great city gate, known as *abullu rabu* in the inscriptions, which was sought for, was discovered. It had been built originally by some pre-Semitic builder in a very substantial manner, who laid up his bricks in bitumen. It has three divisions or entrances; the one in the center, which was the largest, was for animals, those on either side were for the people. While the whole structure was considerably above the plain, approachable by a gradual ascent, the middle entrance was lower than the side passageways, which were reached by steps.

Pre-Semitic Palace.—In tracing the southern limits of the city a large palace of the pre-Semitic period (prior to 4000 B. C.) was discovered. No mound marked its site. It was clearly below the present level of the plain. Only one façade of the building was cleared. It is nearly six hundred feet long, built with two stories, having small windows near the ceilings. A large open terra-cotta vase, several tablets of the earliest known period, a substantially constructed well, and many other antiquities were discovered. Prof. Hilprecht is of the opinion that the complete excavation of this



THE STAGE TOWER OF THE TEMPLE OF BEL—WORKMEN ON THE TEMPLE OF SARGON.

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enormous palace will reveal many important antiquities as bronze and marble statues of the type of those discovered at Tello by De Sarzec. The fact revealed in connection with these and other investigations is that the city in the earliest known period had the same enormous extent as in the late Neo-Babylonian period, and the territory embraced within the walls was at that time more fully occupied.

Temple of Bel.—One of the highest points of Nippur is the conical mound, called *Bint-el-Amir* ("daughter of the prince") by the Arabs who live in the neighborhood. It rises about 95 feet above the plain and covers the ruins of the ziggurrat Imkharsag, the stage-tower of the temple Ekur. About the tower on all sides are the buried rooms and collapsed walls of the temple proper. Considerable time in the past has been devoted to the excavation of this structure. The uppermost stratum of the mound, not unlike nearly all the others examined, was found to be a cemetery, where in the period from about 200 A. D. the residents of Nippur buried their dead over the place where their ancestors worshiped their gods. Beneath this stratum were found the operations of those who built during the Parthian period, when a complete change in the form and character of the structure was made, upon which Prof. Hilprecht will write in the near future.

Beneath this structure was found the temple that had been built by Ashurbanapal (668-626 B. C.). Whether out of his great regard for the Temple of Bel, or for some political reason we do not know, but this Assyrian monarch restored and greatly enlarged the temple which had existed prior to his time.

The next great builder, going backward in the order of time, was Kadashman-Turgu (1250 B. C.). The work of Kurigalzu, Bur-Sin II., Ishme-Dagan, Bur-Sin I., Ur-Ninib and Dungi, of the third pre-Christian millennium was also cleared away after being examined in all details, when the ziggurrat as it was seen in the time of Ur-Gur (2800 B. C.) was laid bare.

On the ruins of what preceded him Ur-Gur built a large pavement or platform, on which he built his temple and ziggurrat. The base of the latter formed a right angled parallelogram 200 feet long by 130 feet wide. It was built with three stages or stories, the lowest being 21 feet, the second 13 feet high, while the third was so much ruined that it was impossible to secure its original dimensions. In their primitive conception the Babylonians spoke of such temple-towers as "reaching unto the heavens." Though they were not very lofty, yet in this very level country they had an imposing and mountain-like appearance. Surrounding this complex was built an immense wall called *Imgur-Bel*, or the inner wall of the city.

About eight feet below the level of Ur-Gur's pavement was found another consisting of two layers of burned bricks. They were 20 inches square by 4 inches thick, most of which were stamped with the legend "Naram-Sin, builder of the temple of Bêl," while a few were stamped with his father's name "Sharganishar-ali (Sargon) King of Accad, builder of the temple of Bêl."

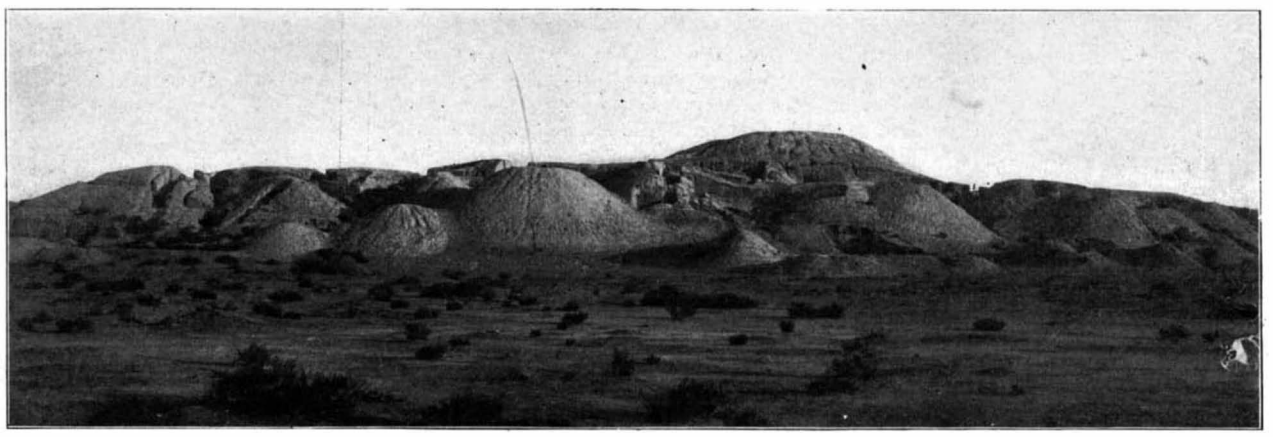
Until recently these rulers, who lived about 3800 B. C., were regarded as legendary characters, largely on account of their great antiquity, but the excavations revealed the fact that the founding of the temple was several thousand years prior to their time. Down the excavators went through "the accumulations of débris from ruined buildings, partly preserved drains, broken pottery and many other remnants of human civilization" not less than 31 feet before virgin soil was reached. Above Naram-Sin's pavement were 36 feet of accumulations, representing over 4,000 years of Babylonian history. Below this pavement were 31 feet representing a period, how long? There are no reasons to think that the accumulations were more rapid prior to that period than later, and to add Prof. Hilprecht's words, "I do not hesitate, therefore, to date the founding of the temple of Bêl and the first settlements in Nippur somewhere between 6000 and 7000 B. C., possibly even earlier."

Belonging to the temple at different periods prior to Sargon's time were found in this early strata an altar covered with ashes of animal sacrifice; several large sacrificial vases made of terra-cotta; a perfect keystone arch, hitherto considered Roman, and many other interesting works of antiquity in bronze, stone, and clay.

To this early period belong the fragments of inscribed vases of about a dozen Babylonian rulers which have been translated by Prof. Hilprecht, and again introduced by him into Babylonian history. The vases were used in the temple service for centuries until the time the Elamites went through the land under Kudur-Nakhundi (about 2285 B. C.), who sacked the temples, carried off to Elam what appeared favorable in their eyes, broke up and scattered what they did not desire. At that time the Temple library and other buildings were destroyed. Some cities were never rebuilt after this invasion. Nippur never fully recovered after this vandalism of the Elamitic hordes.

Temple Library.—On his first visit to the mounds of Nippur, about eleven years ago, Prof. Hilprecht pointed out the place where he thought the temple library ought to be found. In that identical place the library was found. During the recent campaign a portion of the mound was carefully excavated in addition to what had been cleared formerly. Altogether there have been taken thus far from the rooms of the library about 25,000 tablets, mostly unbaked. As only about one-twentieth part of this extensive group of hills has been excavated, in view of the peculiar topographical indications and the history of the temple, Prof. Hilprecht estimates the probable number of tablets yet buried in the library to be from one hundred to one hundred and fifty thousand. They are almost entirely of a didactic character, and belong to the third millennium before Christ. Of the manifold character of the tablets only an exhaustive examination can give a clear idea. Ledges or shelves were built in the walls of the rooms, upon which the tablets were laid in rows. As stated above, the Elamites threw the building into ruins the century prior to Abraham's birth. The importance of this find can scarcely be estimated at the present time, as it will throw so much light upon the history of this early period.

Court of Columns.—Considerable time has been devoted in former years to the excavation of the so-called "Court of Columns." It is situated on the western side of the Shatt-en-Nil in an upper stratum of the highest mound. It belongs to the late occupation of Nippur, about 300 B. C., as determined by Prof. Hilprecht. It was a government building. There were many rooms on three sides of the building around an open court of columns. Some of the rooms were used for the storage of grain and other kinds of merchandise, doubtless representing the tithes or taxes of Nippur's inhabitants. Architectural plans of this building as well as the others excavated have been prepared by the architects who accompanied the expedition.



MOUNDS AT NIPPUR.

Additional Results.—Important inscriptions on clay and stone belonging to all periods of Babylonian history were found during the last campaign in great numbers. In removing the upper stratum of mounds over one thousand sarcophagi, mostly of the slipper-shaped pattern characteristic of the late period (300 B. C. to 700 A. D.) were opened. In these were found gold and silver jewelry in the shape of bracelets, finger rings, nose rings, brooches, clasps; also pottery and many other things. Quite a number of representative specimens of the different burial modes were preserved for exhibition in the museum. Seals and seal cylinders, such as the Babylonians used in their business transactions; several hundred inscribed Hebrew and Mandaic bowls, showing the influence of Babylonian wizardry upon the Jews who continued to live at Nippur as late as 700 A. D., great numbers of vases in enameled and plain pottery, images of gods; playthings in terra-cotta; bass-reliefs, weights; utensils and coins in bronze and iron, etc., were found. Another important feature was the studying of all types and forms of pottery with a view to determining the age of many specimens excavated in former years. As regards portable antiquities of every description having special archæological value for the restoration of Babylonian history this expedition stands prominently in the lead of those at the present time engaged in Babylonia.

These are a few of the important finds without mentioning the numerous minor facts ascertained, and the many questions solved through the personal inspection and study of Prof. Hilprecht while in the trenches which have important bearing upon the religious ideas and customs of the daily life of the Babylonian people, upon which he will write in the near future.

What science owes to the labors and undertakings of all on the staff and the unselfish generosity and interest of the gentlemen who furnished the means to carry on the work can only be properly estimated by posterity. It is expected at no distant date to resume the operations in this land of primitive civilization—the cradle of the universe.

Electro-Capillary Action.

The Constantin Zahrzewski describes in the Bulletin of the Academy of Cracow a series of experiments which he has recently made upon the electromotive force produced by capillary action. He uses for this purpose an apparatus consisting of two large glass vessels united by a capillary tube of glass, silvered on the interior. The vessels were half filled with water; each vessel contained a metal electrode placed in the water at a short distance from the opening of the tube. The movement of the water through the capillary tube was produced by compressing the air in one of the vessels. The experimenter found that the movement of water through the tube gave rise to an electric current, the direction of this current depending upon that of the water. It was found that the electromotive force depended upon the difference of pressure at the ends of the tube and also upon the distance of the electrodes from the opening; when the electrode contained in the vessel toward which the current flows is removed farther from the end of the tube the effect is diminished. The thickness of the layer of silvering seems also to have an effect upon the electromotive force, this being diminished as the thickness of the layer is increased.

Windmill Electric Plants.

M. Gustave Conz, who has recently been making a study of the winds in the northern coasts of Germany, finds that the utilization of windmills for small electric plants will be practicable in these regions. He has already set up a small plant at Kappeln, in Schleswig-Holstein. The windmill is of the Neumann type, having a diameter of 35 feet and a surface of 90 square yards. The speed of rotation of the wheel is regulated automatically and reduced to 11 revolutions per minute; with a current of air of 8 feet per second the windmill will give about 30 horse power. It is connected to a dynamo running at 700 revolutions and giving 120 amperes at 160 volts; a storage battery is connected in parallel with the dynamo. When the wind reaches a speed of 8 feet per second the dynamo runs at normal charge. The tension of the lighting circuit is maintained constant by a rheostat with automatic regulation. To provide for a plant of larger size, capable of furnishing light at a considerable distance by the use of a storage battery, M. Conz recommends using a number of windmills similar to the above, each operating its own dynamo; the dynamos are to be grouped in parallel and are connected to a common storage battery.

A Curious Copyright Decision.

A curious decision as to the right to rebind books, which also involves the question of copyright, was recently given by the United States Circuit Court of Appeals. The court announced that to trim old books, to cut off the edges of the leaves and to rebind them is no invasion of the rights of the person holding the copyright of the books. The court in its ruling put in a proviso that a book so rebound, recovered and offered for sale should have prominently displayed and stamped upon its cover notice that the book was a second-hand copy. The American Book Company have complained that the defendants were selling old school books on which they owned the copyright. They were then revamped and sold. The court in its decision says: "We think that, so far as respects the copyright laws of the United States, no legal right of the appellee was invaded by so doing. What was done was merely the restoration of the books to their original condition when sold by the appellee, or so nearly so as could be done."

An Austrian medical paper states that a physician named Jaz has discovered an anti-typhoid serum which has been applied successfully in fifty cases. The serum is not injected, but is drunk by the patient.

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Correspondence.

Wood-workers' Competition at the Pan-American.

To the Editor of the SCIENTIFIC AMERICAN:

The statement is often made that the number of "all-round" men in the mechanical trades is decreasing, and this statement is, generally, accompanied by an expression of regret for existing conditions in this respect, together with the plea—particularly in the case of those who claim to have the interests of the many at heart—for the maintenance of a broader knowledge of allied trades on the part of skilled workers.

That our present commercial organization is such as to lead to a differentiation of trades and do away with the all-round man is generally conceded, and, I believe, it will be generally admitted that the best interests of the workman, individually, demand of him all-round ability with a high degree of skill in several branches of work.

The question has often been asked, How may we promote "all-round skill" on the part of the mechanic? The answer to this question is to be found in part, in my opinion, in the following: Through competitive trials. I suggest, and I am prepared to enlarge upon, the desirability of competitive trials between all round skilled men.

Would it not be interesting and of value to have at the Pan-American Exposition a wood-workers' contest in all wood-working specialties such as: Manual training wood-work, pattern making, carpentry, joinery, cabinet work, stair building, turning, car woodwork, mill-wrighting, machinery wood-work, carving, etc.? Design to be included in all cases. Would have each man that enters put up a substantial entrance fee.

I would be very glad to enter in the all-round and possibly some of the specialties.

W. R. BRADFORD.

Agricultural College, Michigan,
February 18, 1901.

Are the New Armored Cruisers up to the Modern Standard of Efficiency?

To the Editor of the SCIENTIFIC AMERICAN:

The discussion in your columns of the designs of our three new armored cruisers of the "Milwaukee" class and the six of the "California" and "Maryland" classes has aroused considerable interest in a subject which is near the heart of every true American citizen. The letters published February 9 and 16 seem to hit the nail on the head. There can be no question at all that these ships are lamentably weak in offensive power; and the answer from the Department, easily recognized as such by its customary reference to "a compromise among several opposing interests," by no means explains the matter satisfactorily. "Trial displacement" may be an "indefinite term," but the weights required by the various governments, to be carried on ships of similar class and design, are not so widely different as to rule out such displacement as a basis for comparison. Furthermore, it is certainly "begging the question" to discuss this point, when the displacements mentioned for the foreign ships are 2,000, or even 4,000, tons below ours.

Our department friend mentions the fact that the machinery designed for the new vessels develops only 11 horse power per ton. This is but too true. The "Oregon," designed in 1891, has machinery weighing, all told, 1,009.2 tons. This developed, on trial, 11,111 horse power, or just 11 per ton. This was with Scotch boilers, and was ten years ago. Has steam engineering stood still during the decade? Not if its status in other lines is any index. The introduction of water-tube boilers into warships was loudly hailed as effecting a vast saving in weight. One evidence of this appears on page 253 of "General Information Series," No. XIII., published by the Navy Department in 1894, where the boilers of the "Hekla" and the "Geiser," two Danish cruisers of 1,280 tons, are compared. The official report says:

Another great advantage which the (water-tube) boiler possesses is its small weight as compared with ordinary boilers. This can best be seen by comparing the weight of the boilers in the "Geiser" with the weight of the boilers in the "Hekla." Its ("Hekla") six cylindrical boilers are proportioned to the same horse power (3,000 indicated horse power) as the "Geiser," both ships being of the same type and displacement.

	"Hekla" tons.	"Geiser" tons.
Boilers and all fittings	120.2	90.8
Water in boilers	48.0	17.4
Total	168.2	108.2
Type of boilers	Cylindrical	Water-tube.

Thus 60 tons, or over one-third of the total weight of the boilers in the "Hekla," are saved in the "Geiser." It is well to note that this comparison is between boilers of the same date.

Another comparison on the same page, between locomotive boilers of 3,500 horse power and Thornycroft water-tube boilers of 4,500 collective horse power (designed for the same class of work) shows weights of boilers and mountings to be 82 tons for the former and 71.52 for the latter; corresponding water weights were 30 and 12.78 tons; total weights, 112 and 84.3 tons. Reducing the water-tube figures to a basis of 3,500 horse power, we have 65.6 tons, a saving of more than 40 per cent over the older type.

Turning to our own navy, we find the "Chicago," completed in 1889, with engines and boilers of 5,000 horse power. In 1896-98 she was overhauled, fitted with new engines and boilers, and now develops 9,000 horse power. Part of this increase is attributable to the substitution of triple expansion engines for compound engines; but to the substitution of Babcock & Wilcox water-tube boilers for cylindrical boilers must be credited a large percentage of the saving in weight which enabled her to obtain an additional 4,000 horse power and a considerable increase to her coal supply, on the same weight as that before required for 5,000 horse power. This is the result of about ten years' progress. Where is any evidence of this saving in the new designs?

Admiral Dewey's famous flagship, "Olympia," designed in 1889 and completed six years ago, has machinery weighing 1,162.5 tons, which has developed 17,313 horse power, or 14.9 per ton, and this with cylindrical boilers. The new battleship "Maine" has machinery designed for 16,000 horse power, and weighing 1,130 tons, or 14.16 horse power per ton. This showing will undoubtedly be exceeded on trial. Examples might be multiplied indefinitely, but enough has been said to show that the machinery of the new cruisers does not by any means satisfy reasonable expectations.

Taking 14 horse power per ton as a conservative estimate, we find that for both classes of armored cruisers a saving of from 425 to 450 tons might be effected. This would enable the carrying by each of four additional 8-inch guns (as suggested by Mr. Hoole, in your issue of February 9), at a weight of 115 tons for guns and mounts, and 90 for ammunition; and would still leave some 225 tons for additional machinery power. At the above figures this would mean some 3,000 horse power, or enough to add a knot to the speed of each ship. In case further protection were required for these guns, this would eat up a large portion, if not all, of the 225 tons, but even then the ships would be a vast improvement on the present designs.

To those of us who recognize the fact that our astounding victories during the war of 1812 and in the late Spanish war were in very large measure due to the superb guns and gunnery on our ships, the importance of an overwhelming battery is at once apparent, without need of argument. The large amount of ammunition carried by our new ships has been mentioned. This includes 200 rounds for each 6-inch gun. With due regard to the necessity for an adequate supply of ammunition, yet when we consider the vital importance of striking a first crushing blow, it would seem preferable to have a broadside of (say) 10 such guns, with 120 rounds behind each, than to have 6 guns with the same total amount of ammunition. The chances are very strong that the former battery would disable the latter long before its ammunition was exhausted. In the engagement off Santiago de Cuba the "Brooklyn" fired 473 rounds of 5-inch ammunition, or less than 40 per cent of the amount above mentioned. The proposed addition of four 8-inch guns, however, was estimated at the full government rate of ammunition supply—125 rounds.

The department letter says: "The difficulties in the way of strictly true and impartial comparison are extremely great because of the inaccuracy of information as to details of the foreign vessels which is available to any one writing as your correspondents do." I beg to say that all of the data I have used in the above comparisons comes from official reports of the United States Navy Department; and that the data offered in both Mr. Brown's letter, published February 16, and Mr. Hoole's letter, agrees exactly with what I have obtained from foreign official and semi-official sources. The general features of size, speed, battery, and armor are very easily obtainable, with a high degree of accuracy, by private citizens.

These new ships of ours are important, and we can ill afford to have another "Denver" fiasco on our hands.

SIDNEY GRAVES KOON.

Cornell University, Ithaca, N. Y.,
February 18, 1901.

A Disingenuous Request.

We are in receipt of a communication from a correspondent in the city of Boone, Iowa, who sends $5 and some sketches of a table he is building, evidently intended for some gambling establishment in that town. A plate of soft iron is located about the middle of the board under the cloth, and electric wires pass up the legs of the table and connect with the plate. By pressure of the foot, or by some similar means, the electric current may be established, and the plate becomes magnetized; the loaded dice can thereby be manipulated at the will of the operator. The correspondent has had some difficulty in carrying out his plans successfully, and desires us to assist him in overcoming the defects by specifying "the amount and sizes of wire or ampere turns and size and shape of magnets necessary." We have returned the amount of the bribe offered, and take this opportunity of informing him that we do not care to become an accessory in his crime, and for any further enlightenment he may require in overcoming his troubles we would respectfully refer him to the Chief of Police of the city of Boone.

Automobile News.

Tunis is shortly to have an automobile service for the transportation of passengers over the roads between some of the important localities. Among the projects is a line from Tunis to Bizerte and Medjez el Bab, and from Sousse to Sfax. A syndicate of Parisian capitalists is at the head of the enterprise, and they have lately sent M. Fernand Dubois, a prominent engineer, to Tunis in order to study the routes. If the lines which are already projected prove a success they will be followed by others. The speed of the vehicles which are to be used for this service will be about 12 miles an hour.

One of the great races of the season will be the Paris-Bordeaux, which is now being organized by the Automobile Club of France and the Bordeaux Club; the date of the race was announced for the latter half of May, but the day has not as yet been definitely fixed. It is known, however, that the race will include four classes of vehicles: 1. Machines above 1,450 pounds. 2. Light vehicles from 880 to 1,450 pounds. 3. Voiturettes up to 880 pounds. 4. Moto-cycles. The price of engagement has also been decided upon; these are as follows: Heavy machines, $40; light machines, $30; voiturettes, $20; moto-cycles, $10. The engagements will be received by the Automobile Club of France and Bordeaux Automobile Club. After the arrival at Bordeaux is to be held an aeronautic fête organized by the Aero Club of Paris.

It is stated that the Belgian army is to be provided with a series of heavy automobiles for traction and the transportation of heavy material; the Minister of War is at present actively occupied with the question. The tractors are to be used in times of war as well as of peace; in the latter case they will be used for the various services of the army, in the grand maneuvers and for the rear train of wagons. The horses will not all be sold, however, as the Minister has decided to keep a certain number as a reserve in case of conflagration. In times of peace, the automobile will economize 3 or 4 horses, and in time of war 6 horses per ammunition wagon. For each horse the expense of maintenance is estimated at $100 per year, and a considerable economy will result from the use of the tractors. Each machine is sufficiently powerful to draw a load of 3,000 pounds; its cost per hour is estimated at $0.15, and as the machines are to be in regular use, it is expected that the cost of purchase will be covered in the first year. If the tractors are well constructed they should make about 10 years of service.

The electric cab system which was organized at Paris by the Compagnie Générale des Voitures has been discontinued. From this it must not be argued that electric cab systems in general are a failure; there is no doubt that in the present case the result would have been successful from a financial point of view if the subject had been more carefully considered beforehand. In the first place, the company, instead of choosing one of the types of electric vehicle which had already made its record at Paris, decided upon an English type which was very heavy and ungraceful in appearance; its chief advantage was that the accumulators were contained in a box swung underneath the cab and could thus be removed and replaced easily, but this advantage was offset by its many disadvantages, and it was undoubtedly inferior to many of the French types. The company erected a plant at Aubervilliers, in the neighborhood of Paris, at a much greater expense than was warranted by a system which was only in the experimental stage. The plant was at least three miles from the city, and the cabs were obliged to make thus an extra trip of six miles a day, and over a very bad pavement, taking a consequent amount of energy from the batteries, not to speak of their increased deterioration. The different causes of the failure of the present system may be summed up: Heavy vehicles, of moderate efficiency, accumulators badly hauled, the capacity reduced by extra trips, waste of energy, and great first cost of plant. From this it will be seen it would have been difficult to obtain a success. It is to be hoped that this will not discourage electric cab systems in Paris, and that fresh experiments will be made with one of the well-known types of electric vehicles, whose construction has been steadily improving. A number of other cities of Europe are installing automobile cab systems, and the results of the trials will be interesting.

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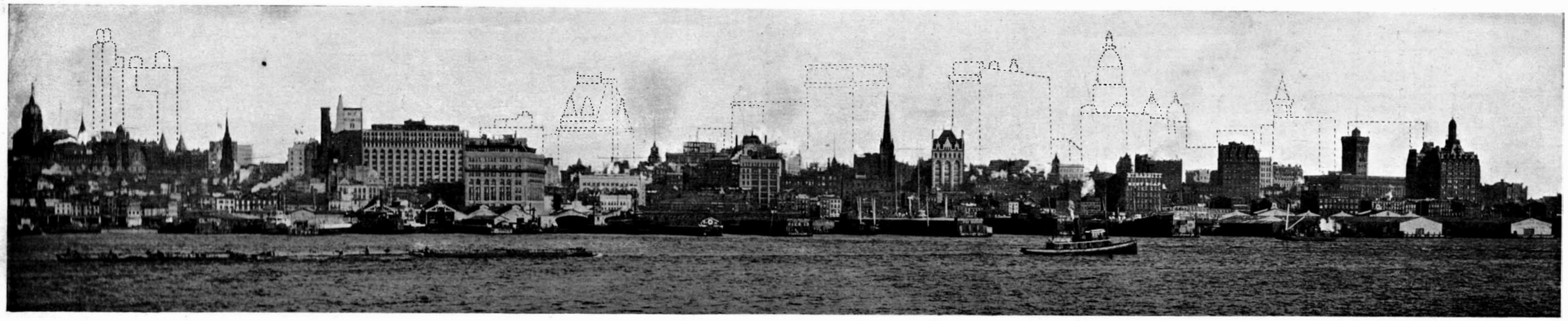
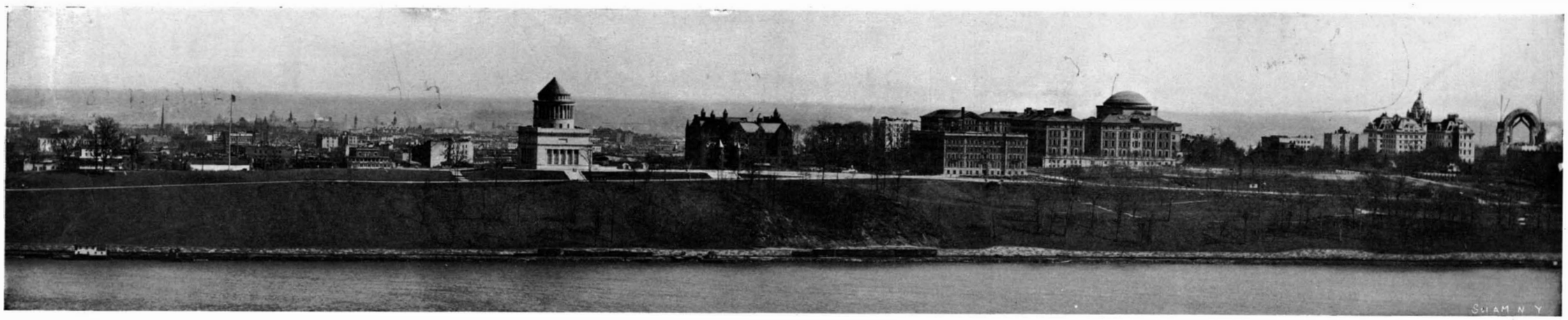
Photo, copyrighted 1900, by G. P. Hall & Sons. Park Row Building, 390 ft. St. Paul Building, 308 ft. Singer Building. Washington Life Building. National Bank of Commerce Building. American Surety Building, 312 ft. Empire Building, 300 ft. Manhattan Life Building, 345 ft. Commercial Cable Building. Johnson Building. Standard Oil Building, 302 ft. Bowling Green Building. Washington Building.

NEW YORK FROM THE JERSEY SHORE IN 1901.



NEW YORK IN 1891, WITH TALL BUILDINGS ERECTED IN THE DECADE 1891-1901 INDICATED IN DOTTED LINES.



Photographs by G. P. Hall & Sons. Grant Monument. Teachers College. Barnard College. Columbia University. St. Luke's Hospital. Arch of St. John's Cathedral.

THE FUTURE ACROPOLIS OF NEW YORK FROM GRANTWOOD ON THE HUDSON.

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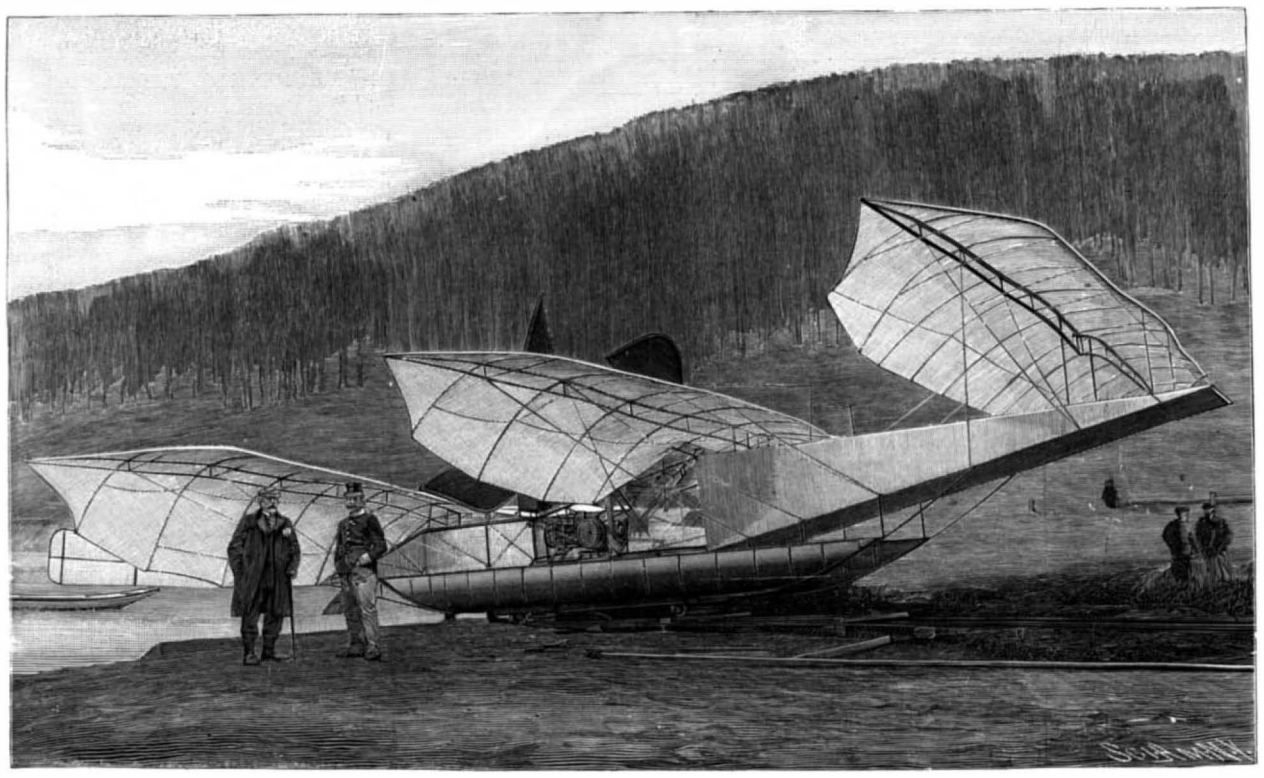
THE KRESS AEROPLANE.

The most recent attempt to solve the problem of artificial flight has been made by W. Kress, a German engineer, who for twenty years has patiently labored on an aeroplane in which he has embodied his ideas.

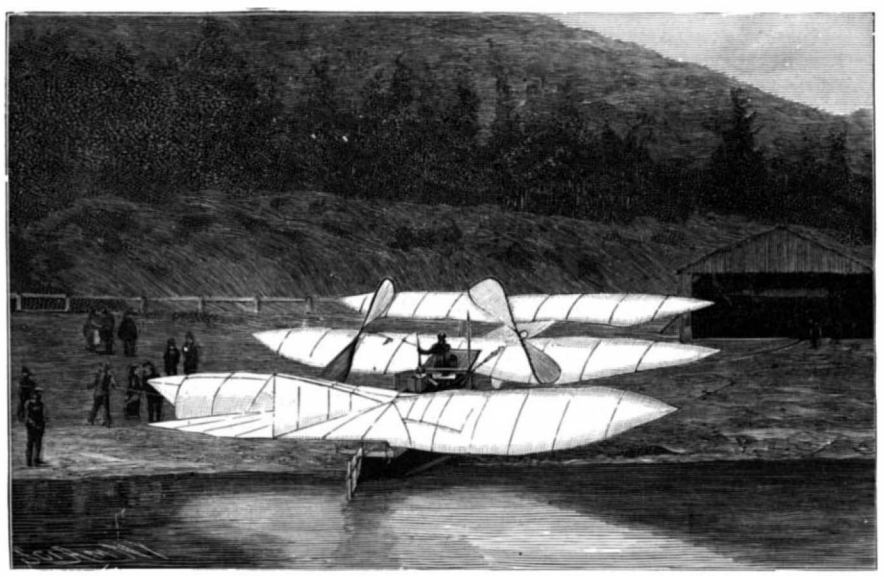
The Kress aeroplane consists of an ice-boat having two keels and a long stem. The keels serve as runners when the machine is traveling over ice or snow. Two resilient sail-propellers, rotated by a benzin-motor in opposite directions, drive the apparatus. Above the boat, arched sails, constituting resistant kite surfaces, are carried, one sail being mounted somewhat above the other, so that it will receive an impinging body of air without interference from the other sails. The aeroplane thus constituted is guided by a horizontal and a vertical rudder, both of which, however, are used only in flying.

Owing to lack of funds the inventor could not equip his air-ship with a benzin-motor of the special construction and power desired, and was therefore compelled to use an ordinary automobile-motor. Thus fitted out the aeroplane was first tried on water. For it is Mr. Kress' opinion that water-trials should first be made in order to ascertain whether the motor, propellers, rudders, and other parts have been properly arranged and are trustworthy and perfectly efficient in operation. Only when the safety of the machine has thus been proven should aerial flights be taken. The sense of security obtained by numerous water-trials and the increased speed attained with each trial will finally give to the aeronaut that confidence which will enable him to soar aloft. That moment, according to Mr. Kress, may come unawares; the ship may of its own accord leave the surface of the water.

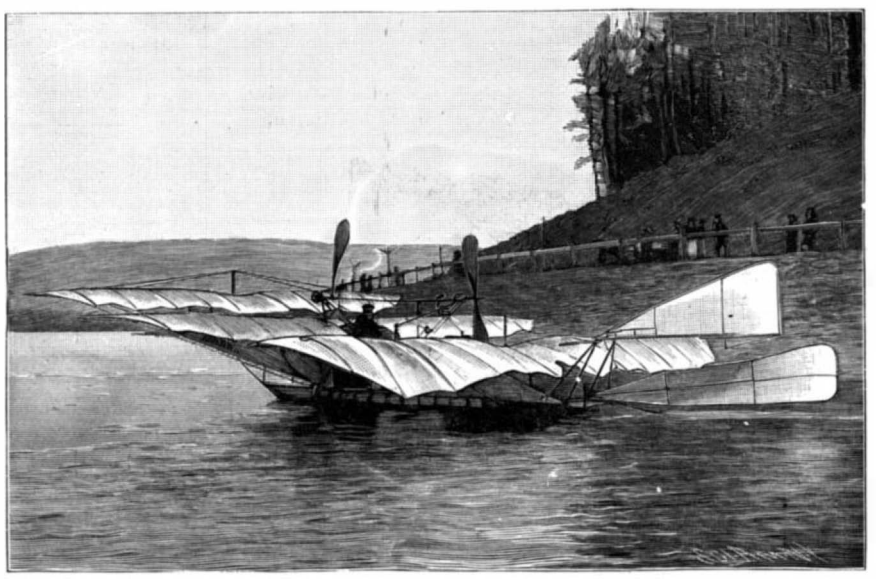
So far as the preliminary water-trials are concerned, the Kress aeroplane seems to have met its inventor's expectations. In the presence of an officer of the aeronautical division of the German army, the flying-machine was taken from its housing and carted to a nearby lake. Kress seated himself in the boat and pulled the starting lever. The propellers drove the machine along at a uniform speed, according to the accounts which have been received. In order to test the maneuvering power of the contrivance Kress is said to have performed various evolutions and to have succeeded even in making headway against the wind. The steering apparatus seems to have acted efficiently. The motor, however, proved inadequate. With a motor of less weight and greater horse power the inventor believes that his flying-machine would be an assured success. Lack of funds may prevent him from carrying out his plan with an improved motor.



THE KRESS AEROPLANE.



THE START OF THE AEROPLANE.



THE KRESS AEROPLANE SAILING ON WATER.

The Italian government has purchased the statues and paintings in the Villa Ludovisi. It has Guercino's "Aurora," one of the best works of the master of the decadent schools. The ancient statues are most important, including the Ludovisi "Juno" and other famous statues, busts, and bass-reliefs.

THE VERTICAL GROWTH OF NEW YORK CITY.

It is a fact that no one in the closing years of the past century left the imprint of his hand so clearly upon the surroundings and conditions of modern city life as the engineer. If anyone doubts this, we invite his attention to the two accompanying photographs showing the sky line of the city of New York, taken, one at the beginning, and the other at the close of the last decade of the century. In the year 1890 the art of composite steel-and-stone building construction was becoming firmly established, and, indeed, in the city of Chicago, to whose enterprise the development of the lofty office building is mainly due, a dozen or more giant structures, ranging from twelve to eighteen stories in height, were to be found in that year scattered through the business portions of the city. New York, ever conservative in municipal matters, whether it be in electric lighting, electric transit or underground construction, was only commencing in 1891 to erect at the southern end of Manhattan Island those towering structures which, to-day, render this portion of the city one of the most marvelous spectacles in the world. Architecture of the composite steel-and-masonry type has helped to solve the most difficult problem with which New York city is confronted. The shape of the island is such that a business center such as that represented in our engravings has no possibility of enlarging its borders, being shut in by the broad waters of the Hudson and East rivers. If room was to be found for the rapidly multiplying financial interests which gravitate to the district lying between City Hall Park and the Battery it could only be secured in a vertical direction by building story upon story and utilizing that free space to whose occupation there was no limit except such as might be imposed by conditions of a structural and operative kind. The limit to the height of these buildings has been determined indeed far more by the conditions of their operation than by any difficulties of a structural kind; since it would be perfectly practical to construct office buildings 500 or 600 feet in height, if there were any advantage in so doing. It was found, however, that the space occupied by elevators became so great, when a building exceeded a certain number of stories in height, as to reduce very seriously the available office floor space, and by common consent it seems now to be agreed that the limit of economic height lies somewhere between sixteen and twenty stories.

The two views of the lower end of Manhattan Island were taken from the New Jersey side of the Hudson River, and in order to make clear the extraordinary height and mass of the new structures, we have indicated upon the sky line view of 1891 in dotted lines the buildings which have been erected subsequently to that date. Commencing from the Battery, we see first the huge western façade of the Bowling Green building, a sixteen-story structure, which had the reputation at the time of its construction of being the largest office building in the world, a claim which we believe has not even yet been challenged. On the opposite side of Broadway, and a little further north, is the Standard Oil building, while to the northwest of it are seen the upper stories of the Johnson building. Facing east on Broad Street is the twenty-story Cable building, conspicuous by reason of the rather shapely twin domes which surmount its eastern façade. To the west of the Cable building, fronting on Broadway, is the Manhattan Life building, one of the first lofty office structures to be erected in New York city. The dome of the Manhattan Life structure was for several years the home of the Weather Bureau Service in this city, and from its flagpole were displayed the storm and weather signals that have come to be so highly appreciated by people both ashore and afloat. On the opposite side of Broadway is the magnificent twenty-one story Empire building, and a little further north, at the corner of Broadway and Pine Street, rises the tower-like pile of the American Surety building, whose coping, like that of the Empire building, is over 300 feet or more above the sidewalk. To the northeast of the American Surety building, and at the corner of Nassau and Cedar Streets, is the National Bank of Commerce building, an eighteen-story structure, while on the opposite side of Cedar Street is a lofty building whose proportions would be more impressive were it not so greatly overtopped by its bulky neighbor. Coming back to Broadway, we see fronting us on the western side of the thoroughfare the stately pile of the Washington Life Insurance building, which can boast of sixteen stories to the cornice, with four additional floors in the roof. Opposite this, at the corner of Liberty and Broadway, is the Singer building. Looking down upon the venerable St. Paul's churchyard from the opposite side of Broadway is the slender pile of the St. Paul building, whose sheer height of 308 feet would look more impressive were it not entirely overtopped by that nearby mammoth structure, the Park Row building, whose topmost office floors are 340 feet above the street level, while the top of the cupolas on the two towers lack only 10 feet of being 400 feet above the same level.

The third view of our series is taken from Grant-

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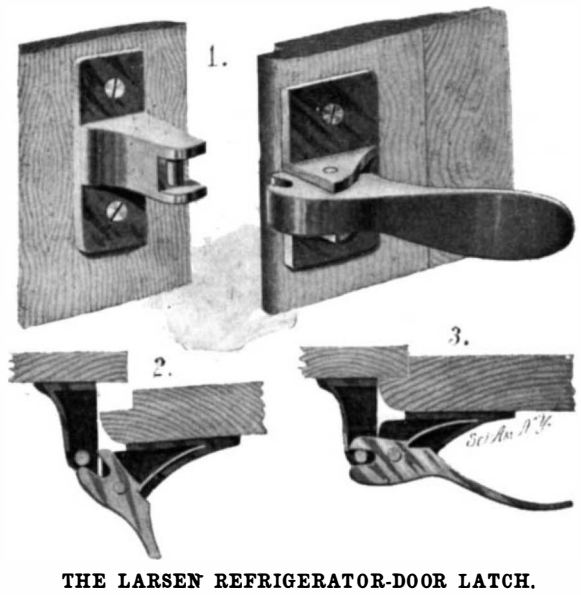
wood, on the New Jersey side of the Hudson River, and gives a comprehensive view of the northern portion of Riverside Drive and the vicinity. It is strongly illustrative of the rapidity with which New York city is growing that all but one of the large public buildings shown in this view have been constructed within the last decade, the one exception being the Teachers' College, which was erected some twelve years ago. Commencing at the right of the picture we see one of the massive arches which will carry the tower, over 400 feet in height, of the new Cathedral of St. John the Divine. To the north of it is St. Luke's Hospital, while the imposing pile of buildings in the center of the picture is the new home of Columbia University. To the northwest of the University is Barnard College, and to the north of it Teachers' College and the classic pile of Grant's Monument. At the extreme left of the picture the high ground begins to slope toward the Manhattan Valley, over which the Riverside Drive is carried by a broad steel viaduct to a high level connection with the Washington Heights beyond. This portion of Manhattan Island may well be called the Acropolis of New York; for by the time the Cathedral has been completed plans for the beautification of this locality will also have been completed which will render it the site of one of the most imposing collections of public buildings in existence.

A SIMPLE DOOR LATCH FOR REFRIGERATORS.

In a patent recently granted to Anton Larsen, of 134th Street and Brook Avenue, Manhattan, New York city, a novel latch is described, by means of which a refrigerator-door can be hermetically sealed when in a closed position without effort on the part of the operator. The figures show the positions assumed by the parts in closing and opening the door.

Secured to the jamb is a keeper having a keeper-pin. On the door a lever is pivoted, formed with a forked or slotted end to engage the keeper pin. A spring presses upon a shoulder on the inner side of the lever so as to hold the lever in an open position, and the slotted or forked end, when the door is closed, passes upon the keeper-pin, so that a further closing of the door will cause the lever to turn on its pivot, owing to the engagement of the pin with the slotted end. When the lever is swung during the closing of the door, the spring is compressed; and when the door has moved nearly into a final closing position, the spring presses on the lever and by its tension closes the door hermetically without the aid of the operator. Thus the spring has two functions—to hold the slotted lever in proper position to engage the keeper-pin and to force the door finally to its seat. In opening the door. the handle is grasped and swung outward, so as to compress the spring until the lever has passed a central position. The door is thus partly opened by the bearing of the lever against the keeper-pin. On a further outward pull on the lever, the door finally swings open, the slotted end leaving the keeper-pin and remaining in position by the action of the spring.



THE LARSEN REFRIGERATOR-DOOR LATCH.

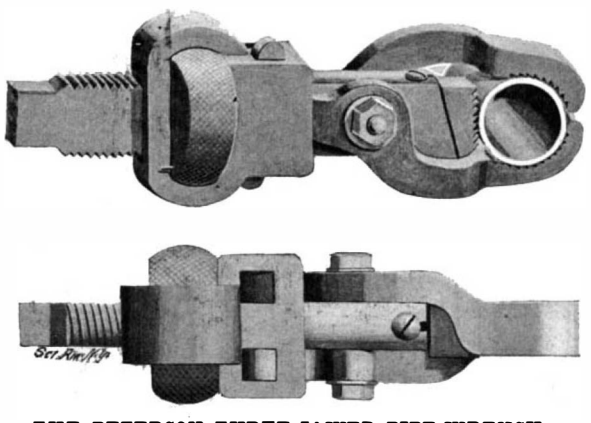
The door-lock is simple in its construction, and therefore cheaply manufactured.

It is stated that Marconi has at last succeeded in solving the problem of transmitting telegraphic messages by his system across great distances. From the results of his experiments which he has just completed, he hopes to be able to place Great Britain and America in communication by this means before the lapse of another twelve months. The high mast which constituted the most important difficulty which militated against the realization of such an accomplishment has been solved. The masts now will not be more than 200 feet in height. Marconi has discovered a process by which he can lengthen the waves to any desired extent, and they will travel the full distance without losing their potentiality to any appreciable extent. The waves travel close to the surface of the water, thus smoothly following the curvature of the earth. Particulars regarding the new apparatus by which Marconi has achieved this end are not yet obtainable, owing to the patents not having been secured, but Marconi is optimistic of the complete practicability of the scheme.

A TRIPLE-JAWED PIPE-WRENCH

A perfectly uniform grip on a pipe without marring or indenting the metal cannot be attained with every pipe-wrench. But in the device illustrated, the inventor, Mr. Christoffer Peterson, of Los Banos, Cal., has provided the necessary means for securely gripping the pipe without the usual attendant disadvantages mentioned.

In the threaded stock of the wrench a spring-pressed pivot slides, on which two main jaws are mounted to turn. By reason of the sliding movement of the pivot,



THE PETERSON THREE-JAWED PIPE-WRENCH.

the jaws can readily grip large and small pipes. The two main jaws are actuated by a slide in which a nut turns, having cut-out portions whereby it can be disengaged from the threads of the stock to permit the free movement of the slide and nut on the stock. By means of pins on the nut, the cut-out portions can be brought in register with the threads on the stock.

In order to engage the pipe midway between the gripping points of the two main jaws, a third, auxiliary jaw is employed, which is held in place by a tongue engaging an inclined groove in the stock. Springs, adjustable in tension by screw-caps on the stock, press against the tongue at bottom and top.

When the three jaws engage the pipe and the handle of the wrench is swung in one direction, the pipe is turned. On the return swinging motion of the handle, the three jaws glide over the pipe without gripping, to permit a fresh hold to be obtained. The auxiliary jaw readily adjusts itself on the pipe to take up any slack in the main jaws, so that the three jaws operate in unison and bear at different points to prevent undue marring or indentation.

AN IMPROVEMENT IN CAPSULING-MACHINES

In order to cover the stoppered ends of bottles and jars, soft-metal caps are used, which are affixed to the neck by machines of special construction. An improved and highly efficient machine of this type has been devised by Eli D. Harrington, of Westfield, N. Y.

To the base of a substantial frame a stationary jaw is firmly secured, which coacts with a movable jaw. Both jaws are provided with rubber gripping surfaces. The movable jaw is carried by a lever fulcrumed in the frame, and is normally spring-pressed to open the jaws.

Movement is imparted to the lever by means of a shaft mounted in the upper part of the frame and provided with an eccentric which, by means of a ball and socket connection, actuates the lever and consequently the jaw. The ball and socket connection, it is evident, readily accommodates itself to the swinging movement of the jaw. The connection is, furthermore, adjustable, so that the movable jaw can be pressed more or less in contact at its side edges with the fixed jaw.

By reason of this adjustable connection the jaws can be set to accommodate the bottle-neck; and by reason of the ball and socket, the cap is properly pressed around the bottle-neck.

Self-burying Fish.

Edward Tregear, of Wellington, N. Z., sends an interesting letter to The Spectator, which we quote in full:

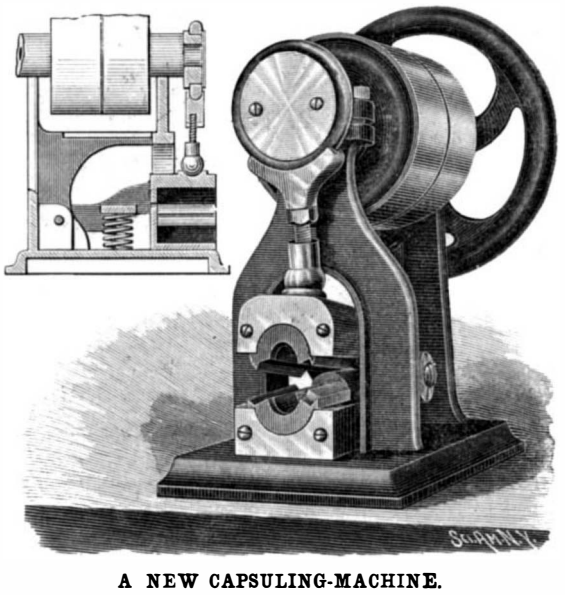
A fish of curious habits exists in New Zealand, and as it has apparently hitherto escaped the notice of naturalists, you will perhaps admit a brief account of it. The fish is called by the Maories the *kakawai*. Its habitat is very extensive in the North Island, and it may be found on the Wairarpa Plains, the Forty-Mile Bush, etc. It is generally discovered when a man is digging out rabbits or making post-holes in the summer-time, and it lies at a depth of a foot or two feet under the soil. The character of the soil, whether sandy or loamy, does not seem to matter. The fish is from two to three inches long, silvery, shaped like a minnow, but rather more slender and tapering. It appears to be dead when exhumed, and if dug up in the summer, and put into water, it dies at once. If, however, it is brought to daylight in May or early June (the end of autumn), when the rains are beginning to make the soil thoroughly wet, and put into a tub of water, a curious thing happens. After a day or two it casts its skin, which sinks to the bottom, and the fish plays about, bright and lively. When dug up in summer, there appears to be a growth of skin, or perhaps of a dry, gummy exudation, which seals up the head and gills. Apparently this enables it to æstivate through the dry weather, and seals the fish as an Indian fakir is sealed up before he goes in for a long fasting burial. Of course, in winter there must be marshy spots or pools in which the fish can swim and propagate, but often all evidence of such natation disappears in summer, and the hot, dry, waterless plain seems the last place on earth in which to find a fish. When the skin is cast off, vivid little spots of red appear on the body, so that some people have said that the fish is a small trout. This is not the case (although they are now used as bait for trout); the *kakawai* was well known to the natives ages before trout were introduced from England; well known, although the name by some chance has been missed in making the Maori dictionaries, just as naturalists have missed noticing the fish.

The Building Edition for February.

The Building Edition for February is the most important number of this handsome magazine which has ever been issued. It is the first number to contain the new features to which we referred in our last issue. In addition to the usual collection of interesting houses, we present several views of the Architectural League Exhibition, now in progress, and also a number of rooms arranged particularly for exhibition purposes by a well-known establishment. The literary contents includes, in addition to editorials, an interview with Bruce Price, Esq., architect of the American Surety building. This interview is most interesting, and the information conveyed is entirely new. "Notes and Queries and Correspondence" and "New Books," "New Building Patents" and "Technical Review of the Month" are a few of the new features. The number is as handsome as it is readable.

The Current Supplement.

Among the interesting articles in the current issue of the Supplement is "Dock Equipment for the Rapid Handling of Coal and Ore on the Great American Lakes," an elaborately illustrated article of which this is the first installment. "Foreign Locomotives at the Exposition of 1900" is accompanied by seven engravings. "The World's Pig Iron and Steel and America's Supremacy" gives a graphic representation of the production of steel by the principal countries from 1873 to 1899. "Some Links Between Natural History and Medicine" is by J. Arthur Thomson. "Progress of Agriculture in the United States" is by George K.



A NEW CAPSULING-MACHINE.

Holmes, of the U. S. Department of Agriculture. "The Optics of Trichromatic Photography" is by F. E. Ives. "Model System of Water Works" is by F. O. Jones, and describes the system which is within the reach of the smallest towns. The usual "Trade Suggestions from United States Consuls" and "Trade Notes and Receipts" are published.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

WHEEL ATTACHMENT.—EDWARD C. FREMAUX, Rayne, La. Wheels of machines used in rice-fields are usually provided with lugs to grip the soft, muddy soil. These machines when drawn over hard roads or ground, are jarred so much that injury may result. The present invention provides an attachment for such wheels to overcome this difficulty. The inventor surrounds the periphery of the lugged wheel with a band of novel construction which enables the machine to be drawn over hard ground as readily as any ordinary wheeled vehicle.

SUB-SOIL ATTACHMENT FOR PLOWS.—ROBERT T. MILLER, Decherd, Tenn. The subsoil plow can be attached to almost any ordinary plow, whether it have an iron or wooden beam, or whether it be a right or left hand plow. The sub-soil attachment consists of a long standard having a blade fixed at its lower end at right angles. A bent brace, pivoted at its lower end to the lower part of the subsoil standard, is extended up to the rear of the standard and provided with a series of holes. A right-angular bracket is bolted to the brace and to the lower side of the plow-beam. The inclination of the standard can be changed by bolting its upper end in any one of the holes in the brace.

Mechanical Devices.

STOPPING DEVICE.—WILLIAM FINN, Manhattan, New York city. The object of this invention is to provide a device for use in factories and mills to stop the machinery in a particular part of a building when an accident occurs. The stopping device comprises a carriage on which is a belt-shifter to shift a belt from a fast to a loose pulley. Traveling motion is imparted to the carriage by a screw-rod, driven by an electric motor. The circuit of this motor is closed by the attendant of a working machine to actuate the motor and impart a traveling motion to the carriage to shift the belt. A signal and alarm device is controlled by the carriage to give a signal.

BOTTLE-WASHER.—EMIL KERSTEN, Richmond, Va. The machine is designed for soaking and sterilizing bottles and consists of a tank containing the heated cleansing liquid, and a wheel mounted to turn and adapted to pass with its lower portion through the liquid. Supports on the face of the wheel are arranged at an angle to support the bottles to be soaked and sterilized. While on the supports the bottles are warmed and tempered by sprays before entering the heated liquid. After leaving the liquid the bottles are kept in a moist or wet condition by sprays in order to reduce the temperature. The wheel is sectionally constructed so that it can be trued by bolts or nuts.

WINDLASS.—DAVID B. CONCLIN, Highland, Ky. This windlass is designed for use in cooperage and particularly in tobacco cooperage. The inventor has provided a device of great strength and simplicity, which is adapted to all kinds of cooperage. The rope and stick now commonly used to twist the joints together are dispensed with. Simply by turning a handle or releasing a pawl the operator is enabled to tighten or loosen the work. The device reduces the labor, since it holds the work just where it is desired.

Vehicle Accessories.

AXLE-BOX.—ANDREAS KATONA, PAUL VARGA, and JOHANN KROMPECHER, Buda-Pesth, Austria-Hungary. The usual axle-journal of railway cars is modified so that its front disk is removed and a separate sleeve mounted on the journal. For its major portion the sleeve is of simple cylindrical shape to give the axle increased thickness at its bearing surface. The sleeve is shrunk on the journal. In order to provide a new wearing surface it is necessary merely to renew the sleeve.

EXTENSIBLE AXLE.—PERLEY W. CARNEY, Portsmouth, Va. Since crops have different intervals between the rows or hills, the width between the rows of one crop does not correspond with the width of another; hence the desirability of a vehicle which can be adjusted to the various spacing of rows in order to avoid mashing down the growing crop. For this purpose Mr. Carney employs a vehicle-axle comprising a bolster having along its edge a strip of metal provided with fulcrum seats or sockets, and two metal axle sections provided with bearing-notches for a tool along their edges adjacent to the fulcrum-strip. Clamping yokes or clips hold the parts together in adjusted positions. The invention comprises essentially an extensible axle.

Miscellaneous Inventions.

ASSAYING DEVICE.—ARCHIBALD CAMPBELL, Surf, Cal. It has been the inventor's main purpose to provide a sand or ore assaying device which can be conveniently carried in the pocket, and by means of which an assay can be made with very little water. The assaying device comprises a bottle-shaped receiver, with riffles on the inner side of one of its walls. The riffled wall is provided with an opening having a removable cover. By rocking the device back and forth, the heavy part containing the gold sinks to the bottom, and the water and sand flow out at the open end. The crushed ore or sand remaining in the device is then allowed to run down, and is evenly distributed over the smooth side, where the particles of precious metals may be easily distinguished by looking through a magnifying or a plain glass formed in one wall of the device.

FIREBOX FOR BOILERS OR FURNACES.—GEORGE CHANTLER, Chicago, Ill. The coal is retained at a point near the front of the furnace until the maximum heating capacity has been exhausted. Air is freely supplied to this mass of coal in such a manner that the best possible results are obtained. The bed of coal is supported on an inclined support, so that the coke can pass down to the lower point of the inclined support to be supplied with oxygen in order that it may be further consumed. The waste gases are conducted from the firebox to a point below the support for the fuel and out through and beyond the structure.

NAIL-GRIP.—HASBROUCK ALLIGER, Kingston, N. Y. When nails are driven with their heads flush with the wood an ordinary claw-hammer cannot be used to withdraw them. The purpose of this invention is to provide means whereby such nails can be readily withdrawn. The nail-grip used has two pivoted sections, each provided with a jaw to engage the nail. A spring tends to push the jaws apart; and a thumb-screw works with the sections oppositely to the spring. The device is to be used in connection with a hammer.

SPIKE.—THOMAS J. W. HICK, Victoria, B. C., Canada. This railway spike comprises two diverging shanks located in the same plane. The upper ends of these shanks are connected by a head having its rear surface concave and flush with the shanks. A lip projects from the front of the head. The under surface of the head and the lift are inclined or beveled from the front edge of the lift to the rear face of the head. The diverging shanks enable a perfectly tight fit to be obtained in the wood. Consequently moisture is not liable to enter at the shank, and untimely decay of the wood is prevented. When the spike is driven home, the shanks do not tear or break the fibers of the wood.

PENCIL-HOLDER.—JAMES F. CALL, Felchville, Vt. The invention combines a holder for a lumber-marking lead, a holder for an ordinary lead-pencil and a rule to measure accurately and quickly the thickness of lumber or other materials. The invention is characterized by the simplicity of its construction.

WINDMILL.—THOMAS S. BARWIS, Vancouver, B. C., Canada. Mr. Barwis has devised a simple and effective construction of wheel adapted to be operated by either wind or water. In his mill, sails or wings are employed so mounted that they automatically feather and otherwise adjust themselves to the wind or water, and offer the least possible resistance when in the wind or in line with ebbing or discharged water.

AUTOMATIC CUT-OFF VALVE FOR GASES.—RALPH E. VAIL, Mount Vernon, Ohio. The casing of the automatic cut-off valve is provided with an inlet communicating with one end of a cylinder provided with a peripheral aperture. A piston fits in the cylinder tightly and is movable beyond the aperture, so that the latter will be between the piston and the inlet. The aperture leads into a connecting chamber provided with an outlet. A valve controls the outlet; and between the piston and the outlet valve is a tripping connection. By this means the supply of fluid can be regulated and its free flow insured as long as it is under pressure. But as soon as the pressure ceases the flow is at once shut off. When the pressure returns the valve must be moved off its seat with the hand.

ANIMAL POKE.—WILHELM SPECHT AND DIETRICH TIEKEN, near Clear Springs, Texas. To prevent cows from tearing down fences the inventors have devised a poke comprising a body portion, at the front end of which the poking device is carried. A pin is carried on the under side of the body near the front; and a yielding protector is arranged under the body at the pin to hold the pin normally out of engagement with the animal's head. The instant that pressure is applied to a fence the animal is pierced by the pin.

COMBINATION KEY AND AUTOMATIC STOP-COCK.—CHARLES T. RANDALL AND EDWARD G. HOLDEN, Dallas, Texas. The purpose of this invention is to provide an automatic arrangement for cutting off the water supply from hydrants when the temperature falls below the freezing point. To this end the inventors employ a device for actuating a cut-off valve, which device is controlled by the expansion and contraction of metals.

CUFF-HOLDER.—ELBERT E. HAWKINS, Wilkes-Barre, Pa. The holder is a single piece of spring metal, and is so simple in its construction that it can be cheaply manufactured, easily applied, and arranged to hold the cuff in a desired position relatively to the sleeve.

FISHING DEVICE.—WILLIAM W. DWIGANS, Arkadelphia, Ark. This invention provides a novel attachment for a fishing-rod and line, which insures the hooking of a fish when the bait has been taken and which, simultaneously with the pull of the fish on the line sounds an alarm to warn the fisherman to capture his fish.

SHOELACE FASTENER.—HENRY A. FRYE, Manhattan, New York city. The fastener for shoelaces comprises a tubular body provided with holding prongs at the center of its bottom, and a longitudinal slot at the top of the body extending from one edge. The prongs are driven through the leather and are then bent or clenched. The upper end of the slot is placed outwardly. The lace is passed through the tube and drawn into the slot and is thus clamped in place sufficiently to resist the ordinary pulling strain to which it is subjected. No knots are required to hold the lace in place.

MATTRESS-SUPPORT.—CHARLES L. FRIEDERICHS, Hancock, Mich. In some sleeping-cars berths are formed by placing mattresses over the ordinary cushions of the seats. The mattresses are apt to sag between the rounded edges of the cushions. To overcome this objection a mattress-support is shown in this patent, which comprises a flat board placed over the meeting edges of two adjacent cushions, so as to form a kind of bridge between the two and to support the mattress evenly at this point.

PLUMBER'S APPLIANCE.—HERBERT N. KIRK, Keene, N. H. The invention seeks to provide an instrument which can be employed to clear the passages of sinks and bathtubs of solid matter. The device comprises a tapering nozzle, on which a yielding sleeve is fitted. A yielding washer is removably secured to the end of the nozzle adjacent to the sleeve. A washer of suitable size is fitted in the end of a nozzle and is inserted in the discharge opening. By turning on water, the obstruction is then forced out of the discharge-pipe.

CLASP AND BELT-HOLDER.—DR. WILLIAM W. BRUCE, 1307 West Fayette Street, Baltimore, Md. The inventor has devised an improved construction of combined clasp and belt-holder for men's shirtwaists. In carrying out the invention a main plate is provided having keepers for a belt; a clamping plate on one side of the main plate for securing the shirtwaist and trousers; and a lever and cover-plate on the opposite side of the main plate, which lever operates the clamping-plate and also forms a cover for the belt.

Designs.

DESIGN FOR SILVERSMITH'S STOCK.—PETER J. GORDON, Manhattan, New York city. The leading features of the design consist of a rococo scroll and fuchsia flowers.

PAPER CLIP.—CHARLES W. MOWEN, Plainfield, N. J. The body portion of the paper-clip has opposite members longitudinally curved and joined at the top. The lower ends are turned inwardly and rearwardly and are connected with a twisted tang, having a longitudinal curve reverse to that of the body members, and terminating in a ring or eye.

BOTTLE.—MORITZ RHEINAUER, Manhattan, New York city. Mr. Rheinauer has devised a pocket-flask divided into three compartments, each having a separate outlet or neck. The three necks are each provided with independent caps. Three different kinds of liquids can be carried in a flask of this construction.

BOX-BLANK.—CARL ENGBERG, St. Joseph, Mich. The designer has devised a box-blank which can be folded so that the parts interlock to form a strong box.

BUTTON.—JOHN D. PHILLIPS, Milford, Mich. The button is to be used in tying fodder and is fastened on the end of a cord which is wrapped around the bundle and then held by winding it beneath the button. An end slit in the button and a face depression at the inner end of the slit receive a knot on the end of the cord.

LEATHER CHATELAINE-BAG.—LOUIS SANDERS, Brooklyn, New York city. The design provides a circular formation of the side faces of the bag; a semi-circular gusset at the bottom and lower side portions of the bag; welts for the gusset and its junction with its side faces; a semi-circular frame at the upper portion of the bag; and inclined surfaces where the ends of the gusset meet the frame.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE STORY OF NINETEENTH CENTURY SCIENCE. By Henry Smith Williams. Illustrated. New York: Harper & Brothers. 1900. Pp. 475. Price $2.50.

The story of nineteenth century science is a well-written, lucid account of what has been done in the past one hundred years and what remains to be done in the century just begun. The chapters are each devoted to a particular branch of pure science, and set forth the development of that branch from its condition at the close of the 18th century to the present day. The omission of an account of the development of mathematics during the century may perhaps be attributed to the impossibility of presenting the subject to the average reader without the aid of involved technical explanations.

TECHNOLOGISCHES LEXIKON. Handbuch für alle Industrien und Gewerbe. Uebersicht der gesammten Technologie der Jetztzeit, zum Gebrauche für Techniker, Chemiker, Gewerbetreibende, Kaufleute u. s. w. Unter Mitwirkung von Fachgenossen redigirt von Louis Edgar Andés. Parts 16-20. Price per part 20 cents.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send your name and address to the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 56.—For manufacturers of plow beams and handles.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 57.—For shops that cut or stamp steel plates for plows.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 58.—For manufacturers of monuments other than stone.

Everlasting monuments of white bronze made by the Philadelphia White Bronze Monument Co., Philadelphia, Pa.

Inquiry No. 59.—For manufacturers of appliances for light mining such as gold pans, portable smelters, etc.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 60.—For manufacturers of cheap, efficient writing duplicators.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 61.—For manufacturers of special lathes or machinery for turning axe handles, pick handles, hammer handles, etc.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 62.—For manufacturers of centrifugal sand pumps.

La Porte Watch School, La Porte Ind. Catalogue free.

Inquiry No. 63.—For manufacturers of machinery for making pieced elbows for stove-pipe.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 64.—For manufacturers of coffee roasters and mills.

A fine line of coffee mills manufactured by Logan & Strobridge Iron Company, New Brighton, Pa.

Inquiry No. 65.—For manufacturers of motor bicycles.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., Spring and Varick Streets, New York.

Inquiry No. 66.—For manufacturers of gasoline engines.

Palmer Brothers, Mianus, Conn. Gasoline engine catalogue on request.

Inquiry No. 67.—For manufacturers of devices for recording the arrival and departure of clerks in a large establishment.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 68.—For manufacturers of hoisting machinery and tools suitable for building purposes.

For hoisting engines, J. S. Mundy, Newark, N. J.

Inquiry No. 69.—For manufacturers of match-making machinery.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 70.—For manufacturers of machinery for making tooth-picks.

For woodworking machinery of all kinds, The Fay & Egan Company, Cincinnati, O.

Inquiry No. 71.—For manufacturers of machinery for making candles.

Send for catalogue of candle-making machinery, Homan & Co., Cincinnati, Ohio.

Inquiry No. 72.—For manufacturers of water-wheels for manufacturing purposes and developing electrical power.

Turbine Water Wheel catalogues on application to Christiana Machine Co., Christiana, Pa.

Inquiry No. 73.—For flouring mill boilers and engines.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines. Correspondence Solicited. Address C. A. M. Box 773, New York.

Inquiry No. 74.—For address of the manufacturer of the "Pittsburg Typewriter."

Inquiry No. 75.—For manufacturers of small spring motors suitable for running small fans.

Inquiry No. 76.—For the manufacturers of an apparatus for heating water for bathroom use to be heated by gasoline or kerosene.

Inquiry No. 77.—For the present address of the Porter Manufacturing Company, Limited, lately of 42 Cortlandt street, New York city. Wanted by party who has one of their engines and desires repairs.

Inquiry No. 78.—For manufacturers of roller bearings and ball-bearings for wagons and carriages.

Inquiry No. 79.—For the address of the Continental Manufacturing Company, perfumers.

Inquiry No. 80.—For a manufacturer of portable iron houses.

Inquiry No. 81.—For information as to process of handling steel by the Tropanis process,

Inquiry No. 82.—For the manufacturer of Naphey's acetylene gas tips, ⅛ foot and 1 foot sizes.

Inquiry No. 83.—For the manufacturer of machinery to remove dents from locomotive headlight reflectors.

Inquiry No. 84.—For parties willing to undertake the manufacture of a soaping device shaped like a top, and to be stamped out of sheet aluminium in quantities.

Inquiry No. 85.—For manufacturers of spectroscopes.

Inquiry No. 86.—For manufacturers of seamless tubing about ¼ inch diameter and about 7 inches long.

Inquiry No. 87.—For the manufacturer of steel that will turn off steel-tired wheels made flat by sliding. Merchant steel being used at present and not being found hard enough.

Inquiry No. 88.—For a company making non decaying wood to be used in making piers in salt water.

Inquiry No. 89.—For the address of Mr. Rollin C. Wooster, who, it is said, has invented a kind of salt which, when put in water, freezes it with its contents.

Inquiry No. 90.—For party willing to make small brass stampings and tubings with thread rolled instead of cut.

Inquiry No. 91.—For firm that could make wood handles of soft wood, 9 inches long by ⅞ inches wide by ¼ inch thick, to be varnished or enameled a dark maroon color similar to lead-pencil finish.

Inquiry No. 92.—For a manufacturer willing to make pipe wrenches according to specifications.

Inquiry No. 93.—For a manufacturer of slicing machines for making potato chips.

Inquiry No. 94.—For manufacturers of cigar cutters to complete smoking sets.

Inquiry No. 95.—For manufacturers of dies to cut leather tufts for mattresses, etc.

Inquiry No. 96.—For manufacturers of complete brick-making plants with a capacity of about one million a year.

The latest brick-making machinery can be had from Henry Martin Brick Machine Manufacturing Company, Lancaster, Pa.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8071) C. F. S. asks: In talking in a telephone, how does the sound get from one end of the line to the other? Does the sound travel or does it not? A. The sound is not carried on the wire from one telephone to the other. Sound waves strike the diaphragm of a transmitter, which vibrates under their impact. These vibrations cause an electric current to vary in strength. This current flows to the receiver and attracts its diaphragm with a force which varies just as the current varies. This causes the diaphragm of the receiver to vibrate just as the current fluctuates, that is, just as the diaphragm of the transmitter vibrates. The vibrations of the diaphragm of the receiver set the air into vibration. This strikes the ear, and is changed into sound by the brain.

(8072) J. McG. R. writes: A claims that a watch movement with ordinary steel balance, hairspring and fork, when inclosed in a steel case, either open face or hunting, can be held in the field of the most powerful dynamo or motor, without the movement becoming magnetized. If the above is a fact, will you kindly let me know why the steel case acts as a preventive? A. It would not be best to surround a watch movement with a steel case in this manner to protect the movement from external magnetism. The steel would become permanently magnetized in the field of the dynamo or motor, and would then affect the steel springs of the watch. The usual protection is afforded by an iron case. Iron is used because it cannot be permanently magnetized. Iron presents very little opposition to the passage of the magnetic flow through it; far less than air or any other substance presents. When the iron-cased watch is placed within a magnetic field, the lines of magnetic flux leave the air and take their way through the iron. They are held in the iron and do not enter the works of the watch inside its iron case, since they must traverse air in order to do so. The movement is thus screened from the magnetism of the dynamo. For complete protection the screening case of iron should be of greater thickness than these cases are usually made. Iron is the only substance known which can act as a magnetic screen.

(8073) D. B. T. asks: Does the latent heat of a solid vary with its temperature? A. No. The latent heat of a solid is the quantity of heat required to melt it. This is not given to the solid except at the temperature at which it melts. When a solid is heated to its melting point, its temperature stops rising, and all the heat which enters it is spent in changing the condition of the solid to the liquid. A solid has no latent heat. It is liquefied by heat, and this heat becomes latent. The term latent is going out of use. It is no longer found in the best text-books. We simply say the "heat of liquefaction."

(8074) F. P. asks: 1. Would it be possible to run the electric motor in Supplement No. 1195 for say 120 miles by putting in extra cells? A. We do not think it possible to run an electric vehicle under ordinary road conditions for 120 miles at a charge. 2. How long does it take to charge the cells in Supplement No. 1195? A. Several hours, varying according to the rate of charging. 3. Would either of these motors be able to travel the roads just south of Lakes Erie and Ontario at all seasons of the year? A. An automobile would be at a disadvantage during the muddy season in the spring.

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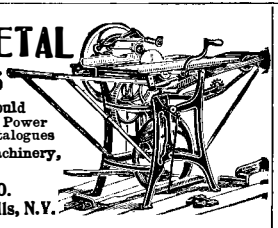

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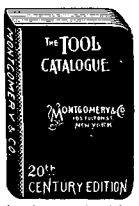

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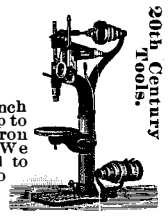

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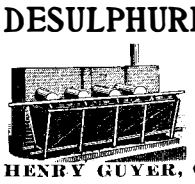

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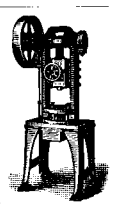

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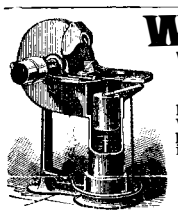

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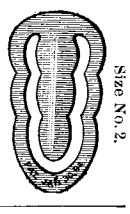

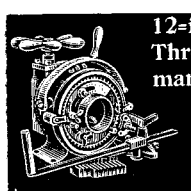

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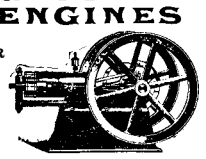

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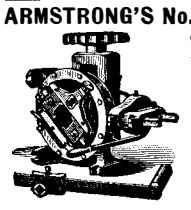

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"American Beauty," for picture blocks, R. Bliss Manufacturing Company..8,138 to	8,140
"Brooklyn Bridge Brand," for cement, New York & Rosendale Cement Company	8,152
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"Teddy's Roach Dust," for an insecticide, Burke Chemical Company	8,144
"Tree Top Pets," for picture blocks, R. Bliss Manufacturing Company	8,135
"20th Century" Poultry Food," for poultry food, J. Haas	8,146
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"Sultar," for a cleaning compound, Sultar Company	304

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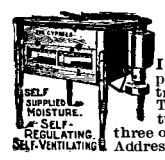

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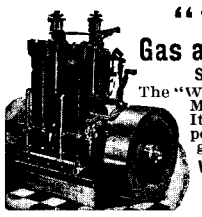

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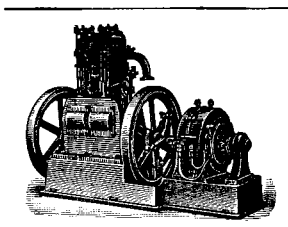

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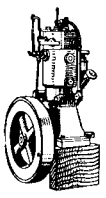

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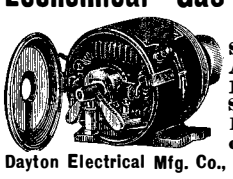

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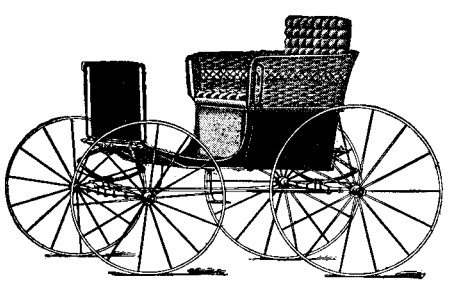

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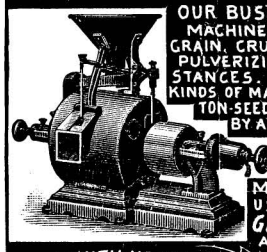

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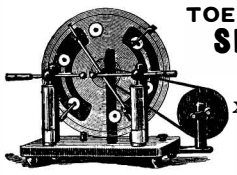

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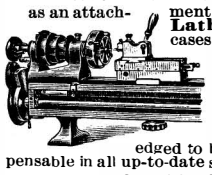

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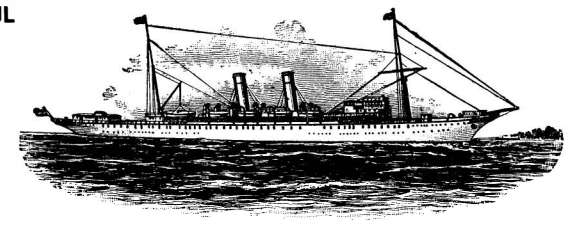

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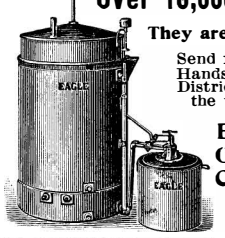

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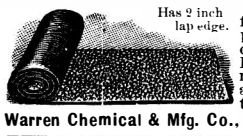

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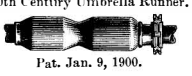

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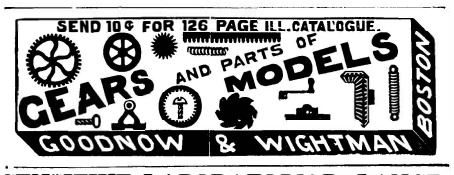

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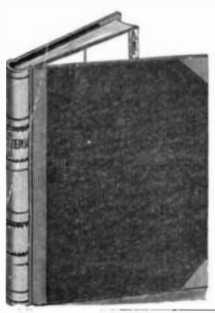

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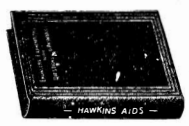

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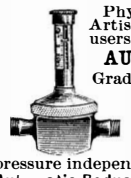

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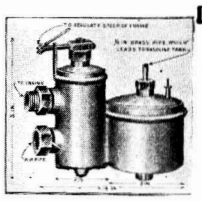

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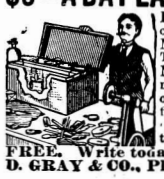

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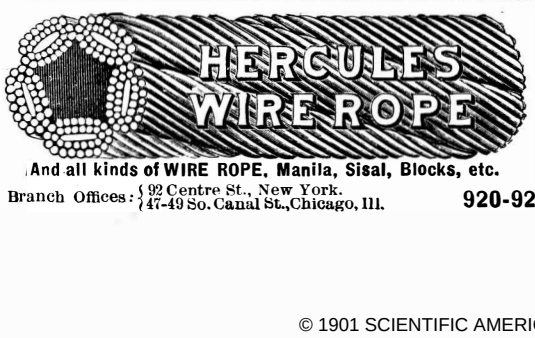

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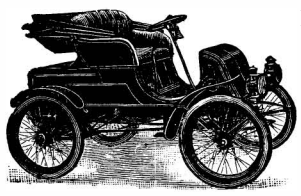

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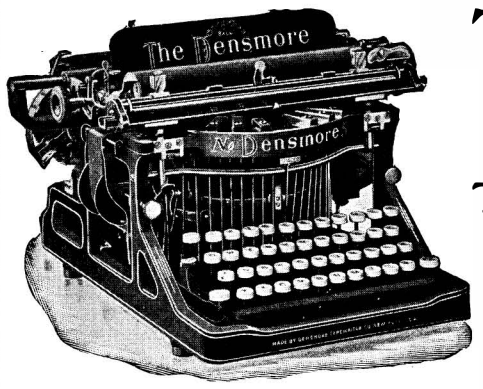

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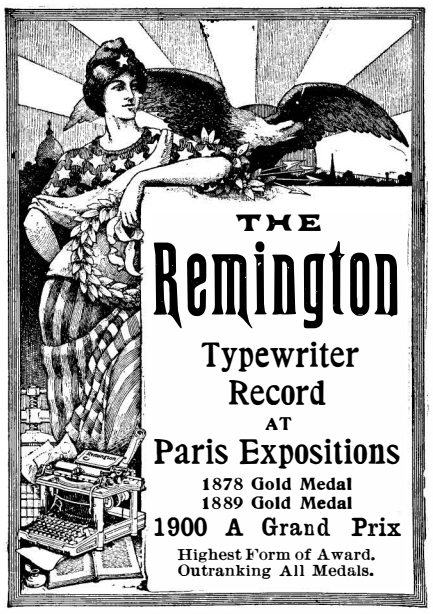

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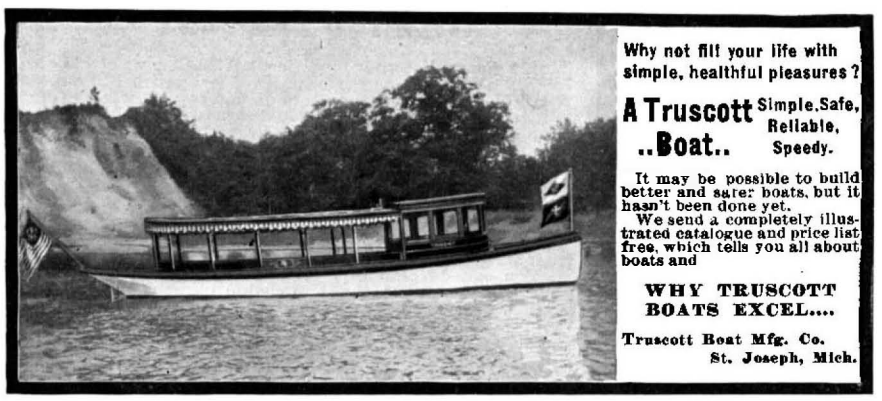

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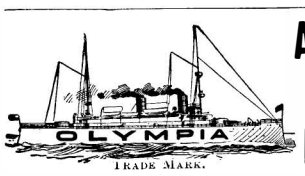

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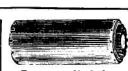

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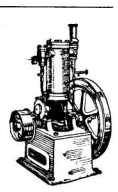

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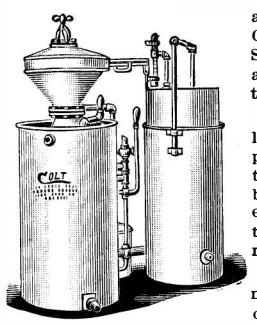

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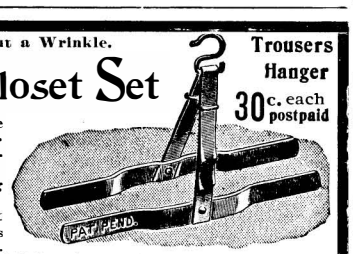

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